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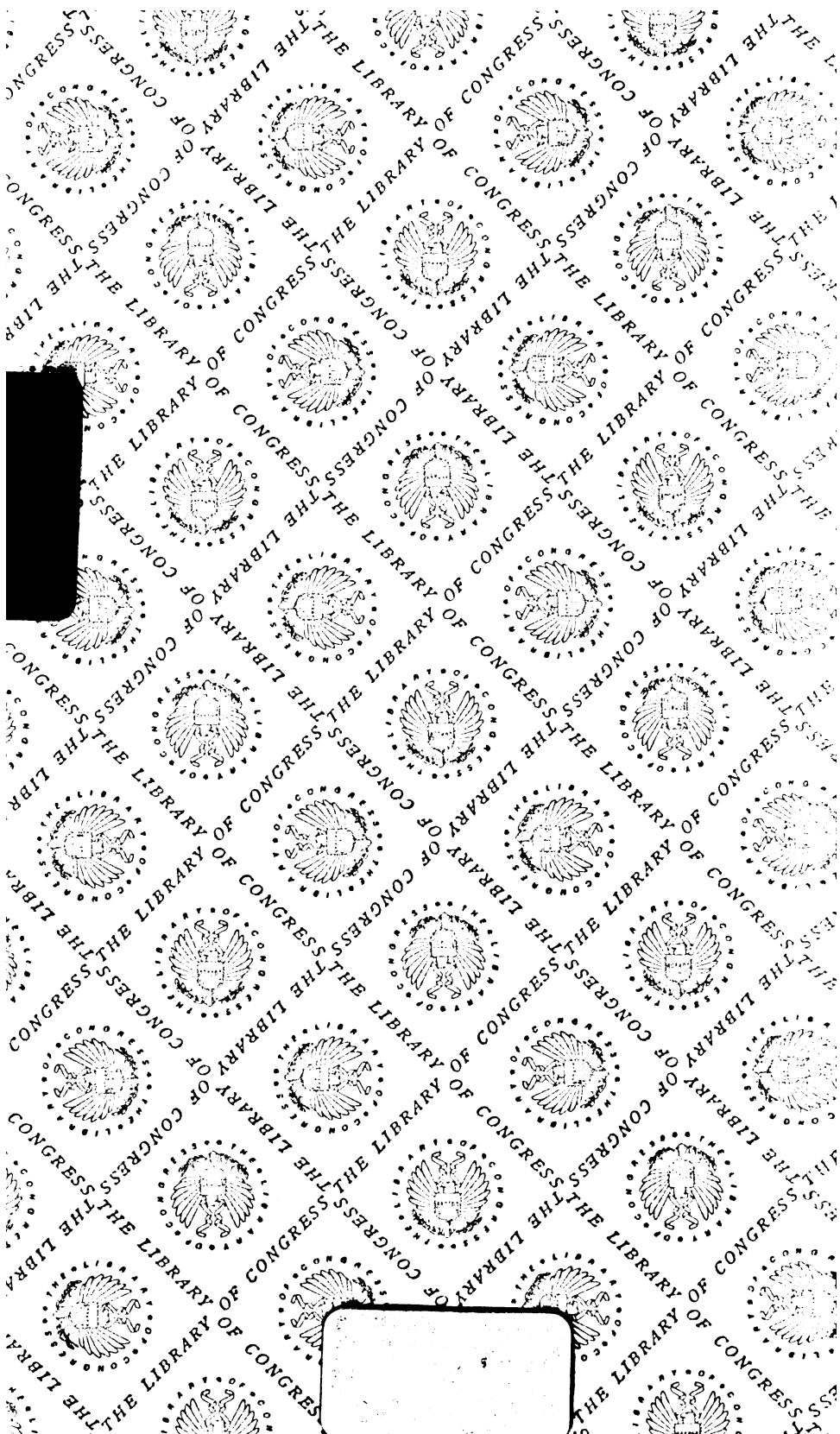
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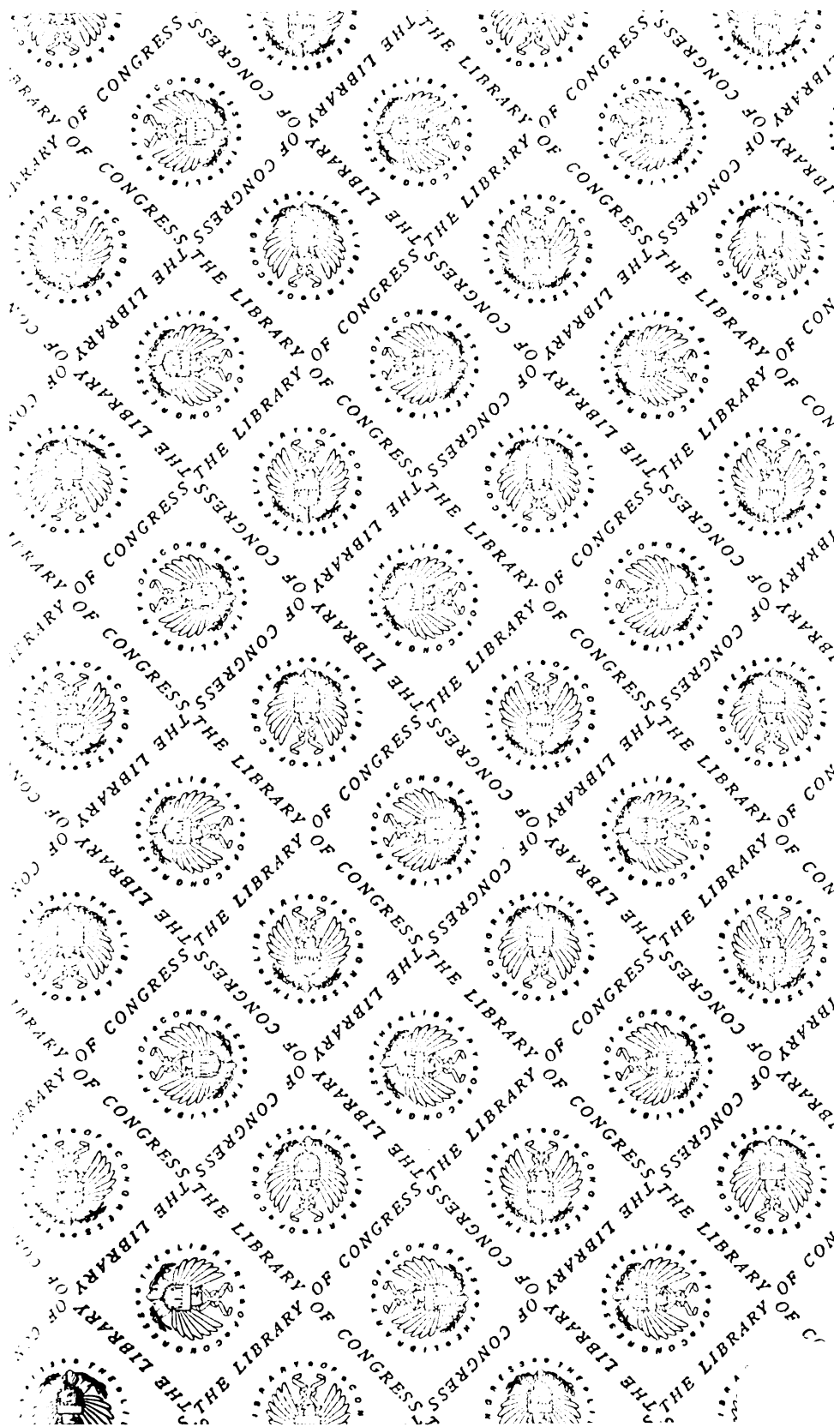
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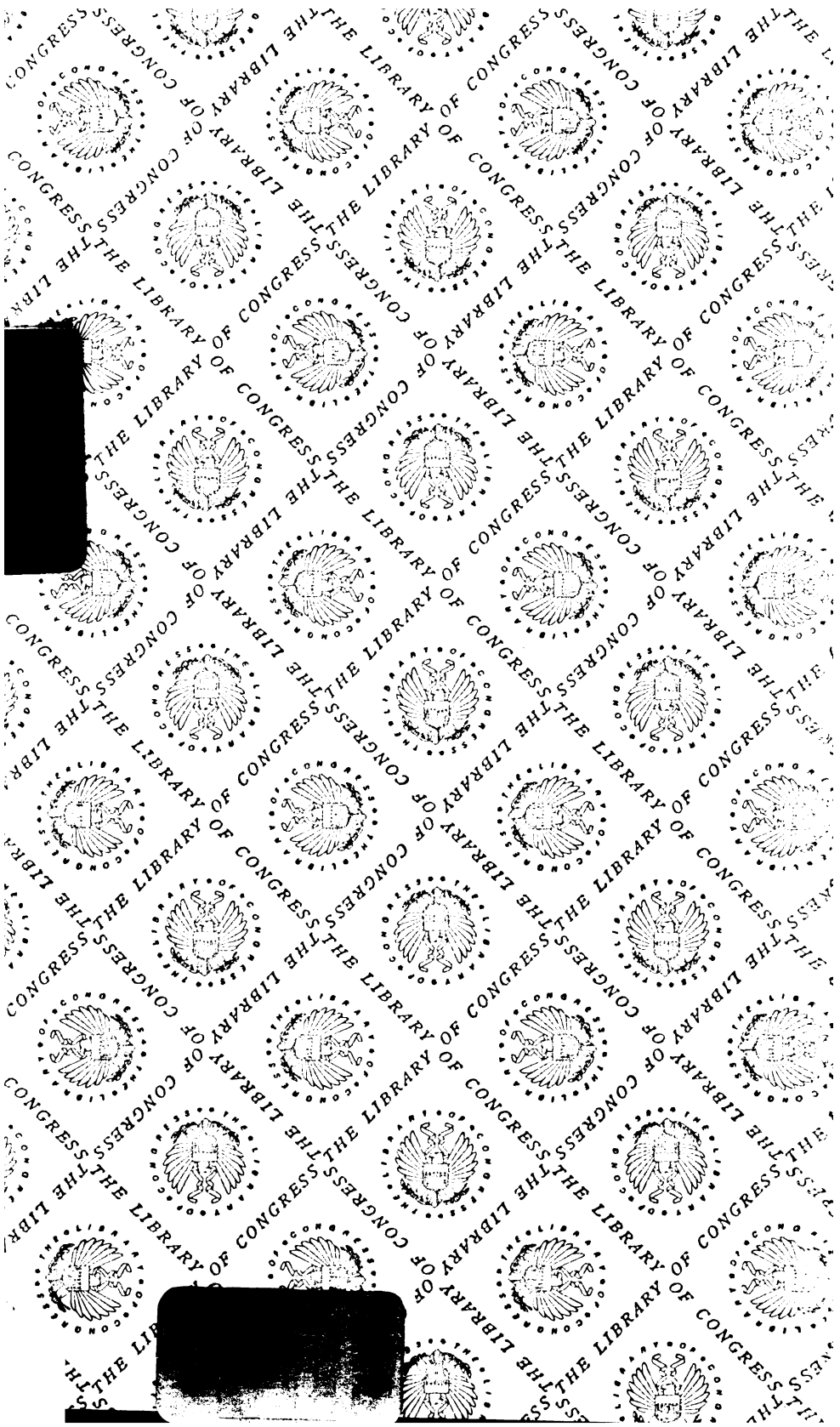
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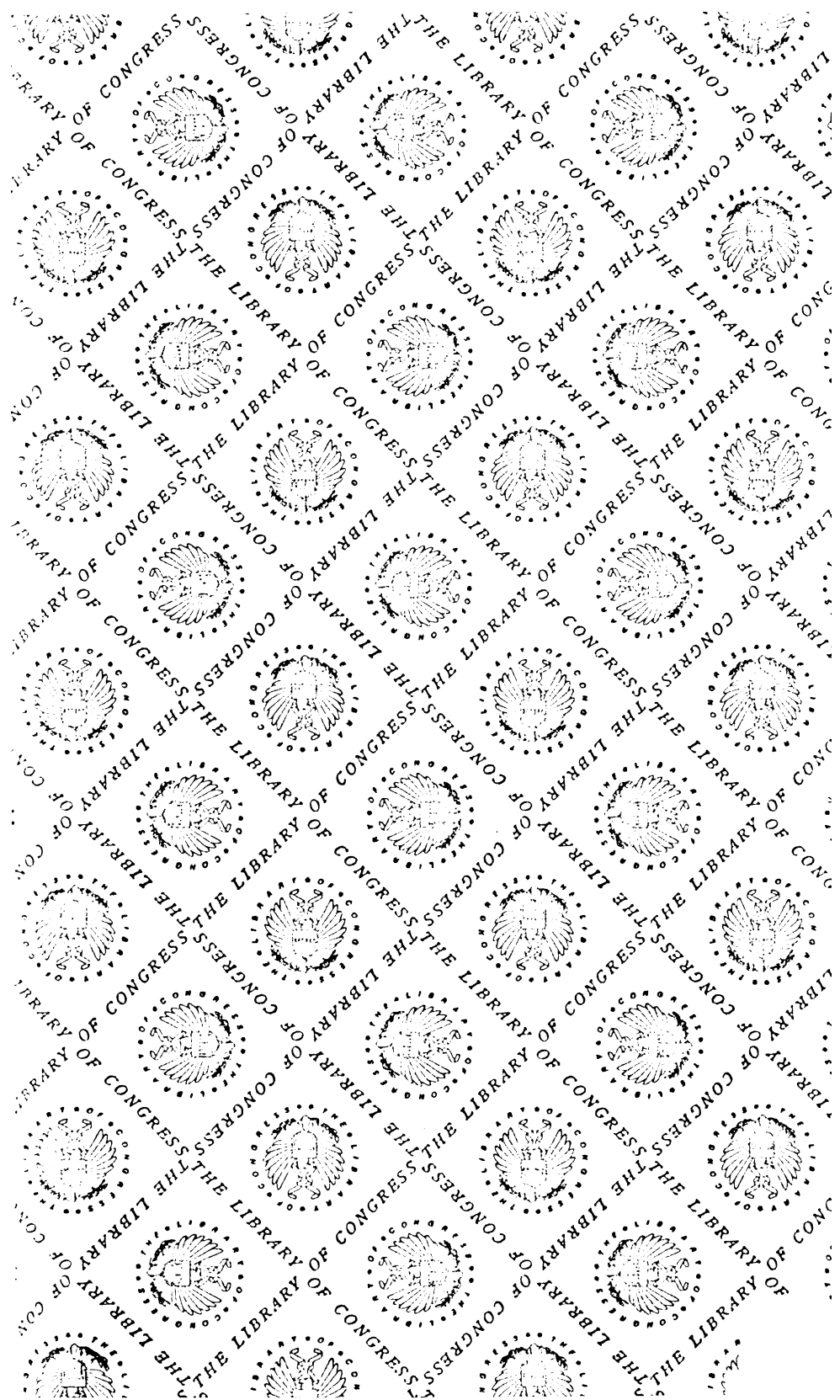
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RADIO COMMUNICATION

HEARINGS

BEFORE

THE COMMITTEE ON THE MERCHANT MARINE AND FISHERIES

HOUSE OF REPRESENTATIVES

SIXTY-FOURTH CONGRESS

SECOND SESSION

ON

H. R. 19350

A BILL TO REGULATE RADIO COMMUNICATION

JANUARY 11 TO 26, 1917



**WASHINGTON
GOVERNMENT PRINTING OFFICE**

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MAY 29 1917

RADIO COMMUNICATION.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 11, 1917.

The committee met at 11 o'clock a. m., Hon. Joshua W. Alexander, chairman, presiding.

The CHAIRMAN. Gentlemen, I set to-day for hearings on House bill 19350, a bill to regulate radio communication, and invited the proponents of the bill to be present to be heard in support of the bill, and stated that the hearings would continue from day to day until they had been heard; that beginning on next Thursday those opposed to the bill might be heard. The text of the bill follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That wherever used in this act the term "radio communication shall be construed to mean communication by any electrical system or method without the aid of wire or other conducting connection; the word "apparatus" to mean machines, devices, and all other equipment used in radio communication; the words "transmitter" and "receiver" to mean the sending and receiving apparatus, respectively, used in radio communication; the word "radiogram" to mean any message, communication, or signal transmitted or received in radio communication; the term "radio station" to mean a place where apparatus is used for transmitting, or for transmitting and receiving, the signals used in radio communication; the term "Government land station" to mean any radio station on land or on a permanently moored vessel, controlled and operated by any department of the Government; the term "Government ship station" to mean a radio station on any ship of the Government controlled and operated by any department of the Government and not permanently moored; and the term "Territory of the United States" or the word "Territory" to mean any Territory, District, zone, insular possession, water, or other place subject to the jurisdiction of the United States, and not within any State.

The word "person" as used in this act shall be construed to import both the plural and the singular and to include a corporation, copartnership, company, or association; and when construing and enforcing the provisions of this act, the act, omission, or failure of any director, officer, agent, or employee of such corporation, copartnership, company, or association acting within the scope of his employment or office shall in every case be deemed to be the act, omission, or failure of such corporation, copartnership, company, or association, as well as that of the person acting for or on behalf thereof.

SEC. 2. That radio stations are divided for the purposes of this act into the following classes:

First. Coastal station, a station on land or on a permanently moored vessel used for the exchange of correspondence with ships at sea. Coastal stations include (a) those open to general public correspondence and (b) those open to limited public correspondence. Coastal stations of class (b) transmit and receive public messages to and from certain stations only, which are designated in the license.

Second. Station on shipboard, a station on board any vessel not permanently moored. Stations on shipboard include (a) those open to general public correspondence and (b) those open to limited public correspondence. Ship stations of class (b) transmit and receive public messages to and from certain stations only, which are designated in the license.

Third. Commercial station, a land station used in the transaction of commercial business and not used for the exchange of correspondence with ships at sea. Commercial stations include (a) those open to limited public correspondence, (b) limited commercial stations, (c) special stations for transoceanic or transcontinental communication. Commercial stations of class (a) transmit and receive public messages to and from certain stations only, which are designated in the license. Limited commercial stations, class (b), are stations of private interest, and carry on a specific commercial service or services defined in the license; they do not transmit public messages to, or receive them from, other stations. Special stations, class (c), are open to limited public correspondence or not, as stated in the license.

Fourth. Experiment station, a land station of private interest actually engaged in conducting experiments for the development of the science of radio communication or the apparatus pertaining thereto.

Fifth. Technical and training school station, a land or ship station of private interest used for purposes of instruction in radio communication and training operators.

Sixth. Amateur station, a land station of private interest not covered by third, fourth, or fifth of this section, and not operated for financial profit. Amateur stations include (a) general amateur stations, (b) restricted amateur stations, which are within five nautical miles of a Government station, (c) special amateur stations, the operation of which seems likely to result in some substantial benefit to radio communication.

Seventh. Government station, a station controlled and operated by any department of the Government.

SEC. 3. That nothing in this act shall be construed to apply to the transmission or exchange of radiograms or signals between points in the same State, if said transmission or exchange shall not interfere with the reception of radiograms or signals from beyond the jurisdiction of the said State, or the effect thereof shall not extend beyond said jurisdiction.

SEC. 4. That no radio station other than those belonging to or operated by the United States shall be used by any person within the jurisdiction of the United States to transmit any radiogram by the apparatus and methods of radio communication, except under and in accordance with a station license or licenses issued by the Secretary of Commerce. Any person who shall operate any radio station in violation of this section shall be punished by a fine not exceeding \$500 for the first offense, and by a fine not exceeding \$1,000 or imprisonment for not more than one year, or both, for each offense thereafter; and any radio apparatus operated in violation of this section shall be subject to forfeiture.

SEC. 5. That the Secretary of Commerce shall approve the rates charged by all licensed stations open to public correspondence.

The heads of Government departments having jurisdiction over Government land stations and Government ship stations shall, in their discretion, so far as it may be consistent with the transaction of Government business, open such to general public business, and shall fix the rates for such service, subject to the control of such rates by Congress. Such executive heads shall arrange, each in his own department, and for stations under his own jurisdiction, for the transmission and receipt of commercial radiograms between land stations and vessels at sea, between land stations and licensed radio stations within the United States or any Territory thereof, and between land stations and radio stations under foreign jurisdiction, under the provisions of the London convention of nineteen hundred and twelve and future international conventions or treaties to which the United States may be a party. The receipts from such radiograms, less an amount not to exceed twenty-five per centum per annum for the necessary expenses of each department for the handling of such commercial business, shall be turned into the Treasury as miscellaneous receipts.

No radio station other than one belonging to or operated by the United States or by the Government of the Philippine Islands, shall be operated on land or on a permanently moored vessel in the Philippine Islands, and no radio station other than one belonging to or operated by the United States shall be operated on land or on a permanently moored vessel in the Panama Canal Zone or in any territory of the United States in the West India Islands other than Porto Rico and the Swan Islands, or in the Pacific Ocean west of the one hundred and sixty-first meridian of longitude west of Greenwich and south of the fortieth parallel of north latitude.

Every Government land station and Government ship station shall have special call letters which shall be designated and published by the Department of Commerce in a list of radio stations of the United States.

Sec. 6. That after three months from the passage of this act and at any time within five years after the expiration of said three months, but not longer, the Government, through the Navy Department, shall have authority to acquire by purchase at a reasonable valuation any coastal radio station now in operation in the United States which the owner may desire to sell.

Sec. 7. That the station license required by section four hereof shall not be granted to any alien or aliens, nor to any foreign Government or representatives thereof, nor to any company, corporation, or association organized under the laws of any foreign Government, nor to any company, corporation, or association of which any officer or more than one-third of the directors are aliens, or of which more than one-third of the capital stock is owned or controlled by aliens or by a foreign Government or representative thereof, or by any company, corporation, or association organized under the laws of a foreign country; and a license shall become void if ownership or management of the station or apparatus shall be transferred to any alien or aliens or to any foreign Government or representative thereof, or to any company, corporation, or association organized under the laws of any foreign Government, or to any company, corporation, or association of which any officer or more than one-third of the directors are aliens, or of which more than one-third of the capital stock is owned or controlled by aliens or by a foreign Government or representative thereof, or by any company, corporation, or association organized under the laws of a foreign country. No company, corporation, or association to which a station license has been issued shall thereafter during the term of the license have any officer who is an alien.

A license shall not be granted to any station not in actual operation at the date of the passage of this act if in the opinion of the Secretary of Commerce the operation of the proposed station will seriously interfere with the operation of existing Government or licensed stations in the vicinity.

Sec. 8. That the station license prescribed by section four hereof shall be issued only in response to a written application therefor, addressed to the Secretary of Commerce, which shall set forth the following facts:

First. (a) If the applicant be a natural person, his name and address, the date and place of his birth; and if naturalized, the date and place of his naturalization.

(b) If the applicant be a partnership or association of natural persons, the foregoing data regarding each member thereof:

(c) If the applicant be a corporation, the date of incorporation and under what laws incorporated, the principal place of business of the corporation, the names and addresses of the officers and directors, a statement as to each officer, specifying his place of birth and the country of which he is a citizen, and, if a naturalized citizen of the United States, the date and place of naturalization, and a statement showing what proportion of the capital stock is owned or controlled by aliens, by foreign Governments or representatives thereof, and by companies, corporations, or associations organized under the laws of any foreign country.

Second. The ownership of the station and apparatus.

Third. The exact location of the station.

Fourth. The stations with which it is proposed to communicate.

Fifth. The purpose or purposes for which the station is to be used.

Sixth. The wave length or wave lengths which it is proposed to use at the station and the period or periods of the day during which it is proposed to operate the station.

Seventh. The proposed rate to be charged per word.

Eighth. Such further information as the Secretary of Commerce may, by regulation, prescribe.

Every application shall be signed by the applicant upon oath or affirmation. If the applicant is a corporation, the application shall be signed upon oath or affirmation by a duly authorized officer thereof.

The Secretary of Commerce may, upon request, determine in advance of the erection of a radio station, on the basis of an application substantially conforming to the requirements of this section, whether the apparatus to be installed in such station will be licensed upon completion of such station and upon what condition such license will be granted.

Whoever shall knowingly make any untrue statement in the application for a license prescribed by this section shall be guilty of perjury, and shall be punished by a fine not exceeding \$2,000 or by imprisonment for not more than five years, or both.

SEC. 9. That station licenses shall be in such form as the Secretary of Commerce shall prescribe, and shall contain a statement of the following conditions, to which such licenses shall be subject:

First. The station shall at all times be subject to inspection by officials of the Department of Commerce; and the President of the United States, in his discretion, may cause the closing of the station and the removal of all radio apparatus, or may authorize the use of the station or apparatus by any department of the Government upon just compensation to the owners, as provided in section fourteen (b) of this act.

Second. The ownership or management of the station or apparatus therein shall not change without the consent of the Secretary of Commerce, nor be transferred to an alien or aliens, nor to any foreign Government or representative thereof, nor to any company, corporation, or association organized under the laws of a foreign country, nor to any company, corporation, or association of which any officer or more than one-third of the directors are aliens, or of which more than one-third of the capital stock is owned or controlled by aliens or by a foreign Government or representative thereof, or by a company, corporation, or association organized under the laws of a foreign country. The ownership or control of more than one-third of the capital stock of any company, corporation, or association to which a station license has been issued shall not at any time during the term of the license be vested in or transferred to an alien or aliens, or to a foreign Government or representative thereof, or to any company, corporation, or association organized under the laws of a foreign country. No company, corporation, or association to which a station license has been issued shall thereafter during the term of the license have any officer who is an alien.

Third. The rates to be charged shall be as approved by the Secretary of Commerce and shall be specified in the license.

Fourth. Apparatus other than that specified in the license shall not be used for radio communication, except in case of emergency or for experimental work authorized by the Secretary of Commerce.

Fifth. Every licensed radio station open to general public correspondence shall be bound to exchange radiograms with any other such station irrespective of the radio systems adopted.

Such license shall also show specifically the ownership and location of the station in which the apparatus is to be used and such other particulars as the Secretary of Commerce may deem necessary for the identification of the apparatus and to enable its range to be estimated, shall show the purpose of the station, the rates authorized by the license, the wave length or wave lengths and the decrement or decrements authorized for use by the station, and the hours for which the station is licensed to work.

SEC. 10. That any station license shall be revocable by the Secretary of Commerce, in his discretion, for violation of or failure to observe any of the restrictions and conditions mentioned in the preceding section or other provision of this act or regulation of the Secretary of Commerce, and such books and records of the licensee as contain entries showing whether or not the provisions of this act are being observed shall be open at all times to inspection by officials of the Department of Commerce to enable them to determine whether such violation or failure to observe has occurred.

SEC. 11. That the actual operation of every radio station for which a station license is required by this act shall be carried on by a person to whom an operator's license shall have been issued hereunder. No person shall operate any such station except under and in accordance with an operator's license issued him by the Secretary of Commerce. The Secretary of Commerce, in his discretion, may grant special temporary licenses to operators of radio apparatus when any emergency arises requiring the prompt employment of such an operator. Whoever shall employ any unlicensed person in the operation of any licensed radio station, or whoever without an operator's license shall operate such a station, shall be punished by a fine not exceeding \$100 for the first offense, and by a fine not exceeding \$200 or imprisonment for not more than two years, or both, for each offense thereafter.

SEC. 12. That an operator's license shall be issued only in response to a written application therefor addressed to the Secretary of Commerce, which shall set forth the name, age, and address of the applicant, date and place of birth, the

country of which he is a citizen, and, if a naturalized citizen of the United States, the date and place of naturalization. The application shall also state the previous experience of applicant in operating radio apparatus and such further facts or information as may be required by the Secretary of Commerce. Every application shall be signed by the applicant upon oath or affirmation. An operator's license shall be issued only to a person who, in the judgment of the Secretary of Commerce, is shown to be proficient in the use and operation of radio apparatus and in the transmission and receipt of radiograms. Except for the operation of a station on shipboard, an operator's license shall not be granted to any alien, nor shall such a license be granted to a representative of a foreign Government for the operation of any radio station. Whoever shall knowingly make any untrue statement in an application for an operator's license shall be guilty of perjury, and shall be punished by a fine not exceeding \$2,000, or by imprisonment for not more than five years, or both.

Sec. 13. That an operator's license shall be in such form as the Secretary of Commerce shall prescribe, and may be suspended by the Secretary of Commerce for a period not exceeding two years, upon proof sufficient to satisfy him that the licensee has violated any provision of this act or regulation of the Secretary of Commerce, or that he has failed to compel compliance therewith by an unlicensed person under his supervision, or that he has been willfully negligent, or has failed in carrying out the lawful orders of the master of the vessel on which he is employed, or that he has willfully damaged or permitted apparatus to be damaged. The license may be revoked by the Secretary of Commerce upon proof sufficient to satisfy him that the licensee was or is ineligible for a license.

Sec. 14. (a) That during any war in which the United States shall be a neutral nation, and in time of threatened or actual war in which the United States may be a party, and in time of public peril or disaster, the President may, by proclamation or Executive order, issue regulations for the conduct and censorship of all radio stations and radio apparatus of every form and nature within the jurisdiction of the United States. Any person who shall knowingly violate or fail to observe any of said regulations shall be punished by a fine not exceeding \$10,000, or by a term of imprisonment of not more than three years, or both; and in case of any such violation or failure to observe any of said regulations, the radio station, or apparatus, or both, shall be liable to forfeiture to the United States.

(b) The President further, in his discretion, may cause the temporary closing of any radio station within the jurisdiction of the United States and the temporary removal therefrom of any radio apparatus for a period or periods of not more than five months each, or may authorize the temporary use of the station or the apparatus thereof by any department of the Government for a like period or periods upon just compensation to the owners.

(c) Radio stations licensed under the provisions of this act shall at all times be subject to inspection by officials of the Department of Commerce.

Sec. 15. (a) That whoever shall maliciously or willfully interfere with or cause any interference with radio communication carried on or sought to be carried on by any radio station or apparatus shall be punished by a fine not exceeding \$500 for the first offense and by a fine not exceeding \$1,000 for each offense thereafter.

(b) Whoever shall willfully divulge or publish the contents, substance, purport, effect, or meaning of any radiogram, or any part thereof, to any person other than the sender or addressee thereof, or his agent or attorney, except to a telegraph or radio station employed to forward such radiogram to its destination, or to proper accounting or administering officers of the various communication systems over which the radiogram may have passed, or to the master of a ship on which he is serving, or in response to a subpoena issued by a court of competent jurisdiction, or on demand of other competent authority, shall be punished by a fine not exceeding \$500 for the first offense and by a fine not exceeding \$1,000 or imprisonment for not more than one year, or both, for each offense thereafter: *Provided*, That this section shall not apply to the divulging or publication of the contents of any radiogram by the sender or addressee thereof.

Sec. 16. That all stations shall give priority over all other radiograms to radiograms relating to ships in distress, shall discontinue all sending on hearing a distress signal, and, except when answering or aiding a ship in distress, shall refrain from sending until all radiograms relating to the ship or ships in distress shall have been completed.

Every coastal station and every station whose operation can interfere with the exchange of messages between ship and ship or ship and coast is required, during the hours it is in operation, to listen in at intervals of not less than fifteen minutes and for a period of not less than three minutes with the receiver tuned to receive messages on a wave length of 600 meters, or as may be required from time to time by future international conventions.

SEC. 17. That when sending distress signals the transmitter of a station on shipboard may be tuned to create a maximum of interference with a maximum of radiation. In all other circumstances all stations shall use the minimum amount of energy necessary to complete any communication.

Every radio station shall use such transmitting apparatus that the energy is radiated in as pure and sharp a wave as practicable and have a logarithmic decrement not greater than the limits which may be specified by the Department of Commerce, but the owner or operator of a station mentioned in section eighteen following shall not be liable to the penalties provided in section twenty-eight for a violation of the requirements of this paragraph unless such owner or operator, after having been notified in writing that the transmitter owned or used by him has been found, upon tests conducted by the Government, to be so adjusted as to violate said requirements, and after having been afforded opportunity for adjusting such transmitter to conform to said requirements shall have continued to violate the provisions of this paragraph.

Receiving apparatus shall be of such construction and so adjusted and used as to give the greatest practicable protection against interference.

SEC. 18. That general amateur stations shall not use a transmitting wave length exceeding two hundred meters or a transformer input exceeding one kilowatt.

Restricted amateur stations shall not use a transmitting wave length exceeding two hundred meters or a transformer input exceeding one-half kilowatt.

Special amateur stations are permitted to use any wave length less than six hundred meters and an amount of power not exceeding the limit which shall be specified in the license, provided the Secretary of Commerce is satisfied that such operation would not interfere with Government, commercial, coastal, or ship stations.

SEC. 19. That the Secretary of Commerce may, in his discretion, grant special temporary licenses to stations to permit the carrying on of tests with any amount of power or any wave lengths at such hours and under such conditions as will insure the least interference with the work of other stations.

SEC. 20. That commercial stations and technical and training-school stations shall not use a transmitting wave length of one thousand eight hundred meters nor any wave length exceeding six hundred meters unless it exceeds one thousand six hundred meters, except in special cases to be determined by the Secretary of Commerce. Such a station shall operate in such a manner as not to cause avoidable or unreasonable interference with Government stations or other commercial stations. Such a station shall not use any wave length between two hundred and six hundred meters if operation at such a wave length would, in the opinion of the Secretary of Commerce, cause interference with coastal or ship stations.

License shall not be granted to a commercial station not in actual operation at the date of passage of this act permitting the use of a wave length between two hundred and four thousand meters, except when so far removed from Government or coastal stations that in the opinion of the Secretary of Commerce no interference can occur with Government or coastal communications.

In considering complaints of interference and in deciding whether the license of a station causing serious interference shall be revoked by the Secretary of Commerce, preference shall be given to stations communicating with ships or between points where other means of communication are not available.

SEC. 21. That every coastal station and ship station shall at all times be ready to send and receive messages and signals on such wave lengths and of such wave character as are required by the existing or future international conventions, one of these wave lengths to be considered as the normal sending and receiving wave length of the station. Such stations may also use one thousand eight hundred meters in accordance with the international convention in force and such additional wave lengths less than six hundred meters or greater than one thousand six hundred meters as may be granted by the Secretary of Commerce. Every such station shall have its receiving apparatus so marked that the operator can quickly and conveniently adjust it to a receiving wave length of six hundred meters or other distress wave length that may be designated by future international conventions.

Sec. 22. That no licensed ship radio station when within fifteen nautical miles of a Government land station or a coastal station shall use a transformer input exceeding one kilowatt, nor when within five nautical miles of a Government land station or a coastal station, a transformer input exceeding one-half kilowatt, except for sending distress signals or signals or radiograms relating thereto.

The Secretary of Commerce may regulate or prohibit the use of the transmitters of stations on shipboard in harbors within the jurisdiction of the United States, as he may deem necessary.

Sec. 23. That no licensed land station in operation on the date of passage of this act within fifteen nautical miles of the Government receiving stations at the following points: Boston, Massachusetts; Newport, Rhode Island; Washington, District of Columbia; Charleston, South Carolina; Key West, Florida; San Juan, Porto Rico; Point Isabel, San Antonio, Laredo, and El Paso, Texas; Fort Huachuca, Arizona; San Diego and San Francisco, California; North Head, Tatoosh Island, and Bremerton, Washington, or of any Government station in Alaska, shall be licensed to change its equipment in any manner that will increase its interference with other stations, and no land station located within fifteen nautical miles of the Government receiving stations herein named, and not in operation on the date of passage of this act, shall be licensed for the transmission of public or commercial business by radio communication.

Sec. 24. That at all important seaports and at all other places where coastal stations operate in such close proximity to Government stations that interference with the work of the Government stations can not be otherwise avoided by the enforcement of this act such stations as interfere with the receipt of radiograms by the Government stations concerned shall not use their transmitters during the first hour of the day commencing at midnight, local standard time, nor during each alternate hour thereafter. The Secretary of Commerce may, on the recommendation of the department concerned, designate the station or stations which may be required to observe this division of time. The Government stations for which the above-mentioned division of time may be established shall transmit radiograms only during the first hour of the day commencing at midnight, local standard time, and during each alternate hour thereafter, except in case of radiograms relating to vessels in distress.

Sec. 25. That whoever, including any person in the service of the Government, shall knowingly transmit or publish, or knowingly cause to be transmitted or published, any false or fraudulent distress radiogram, or who, when engaged in radio communication, shall transmit or publish, or cause to be transmitted or published, any other radiogram for the purpose of defrauding or deceiving the Government shall be punished by a fine not exceeding \$2,000 or imprisonment for not more than five years, or both.

Sec. 26. That no person shall use or operate any radio apparatus on a foreign ship when within the jurisdiction of the United States otherwise than in accordance with the provisions of sections fourteen (a), fifteen, sixteen, seventeen, and twenty-two of this act, and all the provisions of said sections and penalties thereto attaching are hereby made applicable to such apparatus: *Provided, however*, That in no other respect shall anything contained in this Act apply to public vessels of foreign Governments otherwise than by a general proclamation of the President.

Sec. 27. That the office of Director of Naval Communications, established under the jurisdiction of the Navy Department, shall be charged with the accounting and payment of charges in connection with the settlement of international radio accounts as provided by the London radiotelegraphic convention of nineteen hundred and twelve, or as may be provided by future international conventions. The expenses involved in the settling of international radio accounts, not exceeding \$5,000 per annum, shall be borne by the United States.

Sec. 28. That in all cases of violation of any provision of this act for which no penalty is otherwise prescribed, or of any regulation of the Secretary of Commerce, the Secretary of Commerce may impose a penalty of \$100 upon the owner of the apparatus by means of which such violation was effected, or a penalty of \$25 upon the offending operator, or both, but such penalties may be reduced or remitted by the Secretary of Commerce in his discretion; and in addition the Secretary of Commerce may, in his discretion, revoke the station license of such owner and revoke or suspend the license of such operator, as provided in sections ten and thirteen of this act.

Sec. 29. That the Secretary of Commerce shall have power to enforce the provisions of this act by appropriate regulations through collectors of customs

and such other officers, as he may designate; and said Secretary shall also enforce the provisions of such international radio conventions as have been or may hereafter be ratified or adhered to by the United States, except that provisions thereof relating to Government radio installations shall be enforced by the departments respectively controlling such installations.

The Secretary of Commerce is hereby authorized to mitigate or remit any fine, penalty, or forfeiture (other than penalty of imprisonment) incurred under the provisions of section four, section eleven, and subdivision (a) of section fifteen hereof, in the manner prescribed by law for the mitigation or remission of penalties for violation of the navigation laws.

SEC. 30. That, except as otherwise specifically provided in this act, the provisions of this act shall extend to all places subject to the jurisdiction of the United States. The several courts of first instance in the Philippine Islands and the district court of the Panama Canal Zone shall have jurisdiction of offenses under this act committed within their respective districts, and of conspiracies to commit such offenses, as defined by section thirty-seven of the act to codify, revise, and amend the penal laws of the United States, approved March fourth, nineteen hundred and nine, and the provisions of said section, for the purposes of this act, are hereby extended to the Philippine Islands and to the Panama Canal Zone.

SEC. 31. That the act approved August thirteenth, nineteen hundred and twelve, entitled "An act to regulate radio communication," is hereby repealed.

Such repeal, however, shall not affect any act done or any right accruing or accrued, or any suit or proceeding had or commenced in any civil cause prior to said repeal, but all liabilities under said laws shall continue and may be enforced in the same manner as if said repeal or modifications had not been made; and all offenses committed, and all penalties, forfeitures, or liabilities incurred, prior to the taking effect hereof, under any law embraced in, changed, modified, or repealed by this act, may be prosecuted and punished in the same manner and with the same effect as if this act had not been passed.

The CHAIRMAN. Hon. Newton D. Baker, Secretary of War, is present. He is a very busy man and, if there is no objection, we will hear him now, as he wishes to speak briefly in support of the bill.

STATEMENT OF HON. NEWTON D. BAKER, SECRETARY OF WAR.

Secretary BAKER. Judge Alexander and gentlemen of the committee, I have no technical information to place at your disposal—that is, personally; but I want, at the outset, to offer the services of the technical men in the Signal Corps, Col. Squier, Col. Wallace, and others, at any stage of the proceedings, for such information and help as they can give you.

This is not primarily a War Department measure, but it is one in which the War Department has two interests. In the first place, it coordinates with the Navy in the transmission of military information and, second, it looks forward, with the Navy, to the possibility of the country needing complete control and dominance of the wireless situation for the safety of the country.

The features of this bill which are of especial interest to the War Department are those which look to Government control and supremacy in the field of wireless operation. The Navy Department has urged that rather especially upon you, and will continue to do so. And I want to say that the War Department is in entire and hearty accord with the Navy Department in that desire. We believe, in the early stages of the development of this most recent of the advances in science, the necessity has already become clear of complete Government dominance and supremacy. The interferences and things of that sort are matters of technical concern; but the War Department is as one with the Navy in believing that now is

the time to establish the complete supremacy of the Government in this field.

The provision in the bill—I forget the number of the section—which authorizes the Navy to acquire private stations within the next five years, is the one, of course, of chief concern to us all. This bill has had the active assistance, in its preparation on some features of it, of a committee upon which the War Department was represented, Col. Wallace, of the Signal Corps, being our representative, and he assures me that from the military point of view it is approved in every respect by those who are dealing with wireless operation in the War Department.

If the committee, in your hearings, desire to have Col. Squier come down here, or Col. Wallace, it will give me very great pleasure to send them.

The CHAIRMAN. As I recall, Col. Squier was one of the experts who gave us the benefit of his knowledge when the committee framed the original act; in fact, he was one of the parties who assisted in framing it.

Secretary BAKER. I should think that entirely likely, although Col. Squier was in London until just a few months ago.

The CHAIRMAN. Yes; but the original act was framed and passed in 1912, I think.

Secretary BAKER. I do not happen to know whether he was in this country then or not.

The CHAIRMAN. I think he and Commander Todd were the experts who appeared before the committee when we framed that law.

Secretary BAKER. Col. Squier is here now and is available and will be very glad to come at your convenience, at any time.

The CHAIRMAN. Are there any questions of the Secretary?

Mr. HARDY. I do not know that it is pertinent, Mr. Chairman, at this stage of the proceeding, but I would like to have the Secretary tell us whether, in his opinion, an effective control of the wireless stations by the Government can be had in any way except by the ownership of those stations?

Secretary BAKER. I think not, sir. I think that is the only effective control.

Mr. HARDY. We are generally disposed to shy around that term "Government ownership," but in this case the only effective and complete control, in your opinion, would be ownership?

Secretary BAKER. I do not shy at the word; but quite apart from one's general attitude on that question, this, involving the national security of the country, as it does, seems to be separate from all other questions, or most other questions, of Government ownership and control.

Mr. HARDY. I noticed you did not use those words in your statement, and it occurred to me, just as you say, that is the only way to have complete dominance. I am not afraid to use the word.

Secretary BAKER. I like to deal with ideas rather than words, and when a word has gotten a bad reputation which it does not deserve, I sometimes avoid it.

Mr. HARDY. I thought its reputation was pretty bad. Assuming the Government should own these lines of communication by wireless stations, it would not be wise to cut out all private enterprise of the lines by absolutely forbidding their use, and the use of

wireless by private investigators and private inventors, but it is a question of whether or not you can frame a bill so as to permit progress outside of the Government and, at the same time, give the Government complete control. What is your idea about that?

Secretary BAKER. It is very much like having two companies running railroad trains on the same track without complete control by one of the companies. Unfortunately, the transmission of wireless messages is a thing in which interferences are so destructive that unless somebody controls the means of transmission nobody can succeed in it.

Mr. HARDY. Would Government ownership, and of course control, of certain parts of this wireless system enable it to know all that was being done by a privately owned company?

Secretary BAKER. I am not quite sure I catch the scope of the question. If you mean whether the Government stations would be able to receive all messages sent from private sources and analyze and discover their character, I am not certain that is so.

Mr. HARDY. My aim was to know whether it would be necessary absolutely to forbid the private use of the wireless in order to assure the Government complete control.

Secretary BAKER. I do not think it is necessary absolutely to forbid private use of the wireless, but I think the proper plan is to make the Government establishments supreme in the field and to make the advantages of the Government facilities so great that private agencies would desire to withdraw in favor of the Government.

The CHAIRMAN. In other words, looking at it from the standpoint of national defense, the two can not occupy the same field in the event of war or public danger that would impair the national safety?

Secretary BAKER. I think that is unanswerable. To control the wireless, in the event of any superior emergency of the country, it would very likely be necessary—probably would be necessary—to close all private transmission machinery.

The CHAIRMAN. And not wait the event of war; but there are certain other conditions?

Secretary BAKER. It would be a very harsh thing to do, to wait for war to break out and then take over the commercial stations; it would be a very harsh thing to interfere with private interests. But as provided here, the commercial facilities would become an agency to our national defense, and then, if the Government should require them, it could take charge of them without harsh action against private interests.

Mr. HARDY. I do not know that I can get my idea clear enough to present to you, but what I want to do is to avoid the absolute closure of that field to private investigation and invention; to leave it so that private enterprise and invention and investigation could still operate, but, at the same time, retain the complete control by the Government, and domination, as you use it.

Secretary BAKER. I should be very hopeful that that could be controlled and have no doubt it can be; but as it involves technical questions, I am sure Commander Todd would be a better witness on that subject than I.

Mr. SAUNDERS. Is it the purpose of this bill that the Government shall exclusively operate radio agencies?

Secretary BAKER. No, sir; the bill does not say so, and it is not its purpose as I understand the purpose.

Mr. SAUNDERS. What is it? I did not gather from what has passed what the purpose of this bill is.

Secretary BAKER. I perhaps ought not to undertake a definition of it; but as I understand it, it is to provide for operation, through the Navy Department, of the coastal stations, placing the Navy Department in a position where private agencies will desire to transfer their operations to the Navy Department, ultimately leading to a monopoly in wireless transmission in the Government through the Navy Department.

Mr. SAUNDERS. Pending ultimate consummation of it, it is contemplated that private agencies may operate radio stations?

Secretary BAKER. I so understand the bill; yes, sir.

Mr. SAUNDERS. Does this look, then, substantially, simply to taking over in war time the absolute control of radio operation?

Secretary BAKER. I think not. I think it looks to beginning the taking of it over now under equitable and favorable terms to existing private interests and rather intends to discourage further building up of private interests in that field, except in a minor way it will lead to a further development of the art.

The CHAIRMAN. Commander Todd, will you direct the order in which those to speak in favor of the bill are to be heard?

STATEMENT OF COMMANDER D. W. TODD, UNITED STATES NAVY.

Commander TODD. Mr. Chairman and gentlemen of the committee, the bill before the committee was prepared by a committee of 14 members representing every executive department of the Government, including all of the nonmilitary departments, such as Interior, Labor, and Post Office. Every one of them had one or two members. Their deliberations have extended over a full year. This is the best the committee could do, but since we have offered this bill to this committee the Secretary of the Navy has come out flat-footed in a very strong indorsement of the bill plus the idea of Government ownership of all radio stations that do a commercial business; not only on the coastal stations as covered in this bill, but the purchase at this time of existing high-power stations and others that handle commercial business; with the idea that it is a military necessity and a form of preparedness, and because purchase at this time will save the Government a considerable amount of money, as it is something that must be done in the end. There is no escape from it from the point of view of the Navy Department.

Secretary Baker has affirmed those ideas very strongly here, and the term "Government ownership" is now on paper in good form.

This idea of the purchase of all stations handling commercial work, as I said, goes beyond the provisions of this bill. This bill is a comparatively mild measure, in that it suggests Government ownership, looks toward it, makes it clear that that is the idea of the committee and all of the departments concerned—that Government ownership is ultimately to result.

The CHAIRMAN. Commander Todd, it may be I should have asked you a question or two in reference to your connection with this whole subject. You are a commander in the Navy?

Commander TODD. Yes, sir.

The CHAIRMAN. How long have you been a student of the wireless art?

Commander TODD. For over three years, commencing in 1910; I was on duty in the Navy Department with duties solely in connection with radio telegraphy.

The CHAIRMAN. You are one of the experts who appeared before the Senate and House committees in 1912, when the radio act was passed of which this is an amendment, were you not?

Commander TODD. Yes, sir; except that I do not call myself an expert in the presence of so many able men around me whom I recognize. I had a great deal to do with the preparation of the act now in force.

The CHAIRMAN. As I recall, you and Col. Squier were both before this committee at that time.

Commander TODD. Yes; and also Mr. Chamberlain and many other gentlemen here present.

The CHAIRMAN. Yes.

Commander TODD. After a cruise at sea, I was ordered back to the same duty but in another capacity. I was ordered to succeed Capt. W. H. G. Bullard as head of the Naval Radio Service. I also succeeded him in the chairmanship of the interdepartmental committee which framed this bill.

The CHAIRMAN. And you are now head of the radio service?

Commander TODD. Yes, sir.

The CHAIRMAN. Proceed.

Commander TODD. I believe that the committee has by this time received, or is receiving strong indorsements of this idea of Government ownership from all the departments of the Government which took part in the framing of this bill; and if they are all as strong as the indorsement of the Secretary of the Navy, the Secretary of Commerce, the Secretary of War, the Secretary of the Treasury, and the Secretary of Labor, the committee will have something of more weight to work on than anything I can say here.

I should like to start back a few years and show the Government's connection with this subject of radiotelegraphy. In 1898 Mr. Marconi accomplished the unprecedented feat of communicating 20 miles over water at some yacht races at Cowes, Isle of Wight, England. Early in this century he came here and demonstrated the value of radiotelegraphy to the Navy Department and to other departments of the Governments by experiments on some of the latest ships of the Navy at that time, notably the *Massachusetts* and *New York*. The paramount value of this invention for naval operations was recognized at the time and has been a matter of the greatest interest and value ever since; and in all I have to say here I will emphasize the necessity for legislation along these lines to increase the value of the radiotelegraphy for the defense of the country.

As soon as the value of the art was demonstrated, several departments of the Government started to put up stations. They soon discovered that the question of interference, not only with commercial interests, commercial ships, and naval ships, but with one another, was a very serious one, and they decided among themselves to give the Navy a free hand on the coast; the War Department to put up such stations as it needed for its own purposes and the Navy to furnish

communication with ships at sea and such other communications as other departments of the Government needed or might need.

At the same time commercial companies commenced putting up stations at the most prominent points around New York, Boston, Philadelphia, and other great ports, and gradually extended their systems. Rivals put up rival stations until there were altogether too many stations in any one district. This condition exists to this day.

Congress has always been very liberal to the Navy Department in the matter of furnishing money for erecting stations; and before 1906, or about that time, we had a system of stations on both coasts of the United States and in some of our outlying possessions. Wherever there was a naval station they provided a radio station, plus a number of others put up at prominent points along the coast for the safety of life at sea, for the collection of data for the Weather Bureau, for communication with Government vessels, and to issue storm warnings and other information of use in the navigation of ships. Through this liberality of Congress this system has gradually extended in the number of stations, especially covering Alaska, the Canal Zone, and the Pacific islands, pretty thoroughly.

Then Congress appropriated special money for high-power stations, of which we have two working, one to be opened this month and two others and two lesser ones—medium power—to follow during this calendar year. And with the increase of efficiency of apparatus the Navy Department has been enabled by generous appropriations to keep up with the progress in the art, has fitted up its stations with the latest apparatus, and is continuing to do so right along. The result is that we have run ahead of most commercial concerns in efficiency of apparatus and, we believe, in efficiency of operation.

There was no law governing radiotelegraphy whatever up until 1912. That is, six years after the Government stations were put up all stations were left to their own devices—were left to interfere with ships and with one another. But the increased use of Government stations made it plain that they must have their chance to work, and that commercial ships and stations must be protected from one another. In 1910 a bill was prepared and passed the Senate, I believe, was sent to the House, unanimously recommended, but was not reached on the calendar. It failed on account of lack of time. Nothing happened in the next year, but in 1912 the same bill came up and finally passed—a measure that has been administered very successfully by the Department of Commerce since then. I think it has been administered with great impartiality, and the commercial concerns who have operated under it and who opposed its passage are satisfied with it as it stands.

This present bill is an amplification of that. It is a smoothing out of certain features, a rearranging of the requirements, a clarification of the language and definitions, plus the idea of Government ownership, which I would like to touch on particularly as I reach the section containing it.

With your permission, Judge, I should like to go promptly through the sections and state what they are intended to cover.

The CHAIRMAN. I think that would be a proper way to proceed.

Commander TODD. Section 1 contains the definitions necessary to simplify the sections further on, especially the term "territory of

the United States," or "territory." It saves a lot of wording further on. Also the word "person" is defined in such a way as to make it apply to every person, corporation, or association of owners of stations.

Section 2 defines the different classes of radio stations in the United States. Radio communication is used for a number of purposes, some of them necessary and some of them unnecessary, but all existing, and all existing under regulations of the Department of Commerce, except the Government stations, ship and shore, which are under the control of the War, Treasury, and Navy Departments. The "coastal station" is a station that communicates with ships. We maintain as a matter of principle that ship to shore communication is the one most entitled to protection. Ships have no other means of rapid communication, while in other instances the land wires and cables can handle the work; and when there is any interference with ship-to-shore communication, overland or oversea communication steps aside.

I should like to go back and say that internationally this matter is covered by a convention signed in London in 1912.

The CHAIRMAN. How is that?

Commander TODD. I was speaking of the convention signed in London in 1912 and ratified by the Senate. It contains all the regulations necessary for smooth working between ship and shore; that is, between merchant-ships and shore. And we, in ratifying that convention, have obligated ourselves to protect the ship to shore communication for ourselves and for the commerce of other nations.

The CHAIRMAN. When you extend or revise your remarks won't you insert in your hearing those provisions that are apropos in this connection?

Commander TODD. Yes, sir. This bill is based fundamentally on that convention, and the convention as a whole should go in as one of the appendices. There is hardly a paragraph in this measure that does not in some way rest upon the London convention. (See pp. 436.)

The next station, a station on shipboard, is one that we wish to encourage and help in every way we can. Our interest is in the operation of the shore end of the commercial work with ships.

The commercial station is defined as a land station which is not erected or not licensed to communicate with ships at sea. That may be a long-distance communication overseas in competition with cables, or may be, as it is in some cases, one or two on the Atlantic coast and one on the Pacific coast, where they are in competition with land lines.

Fourth is experiment stations, which allows the manufacturer of apparatus and scientific men to have their stations for testing and developing apparatus. This bill takes particular care that nothing shall be done to retard the art of radio communication.

Technical or training stations are of the same character. They are for the training of operators and for instructing the students of technical colleges in the art.

Sixth is the amateur station. The amateurs were regulated to a certain extent by the act now in force, and this bill does not in any way change their status. It does not restrict them or increase their activities. They have increased to enormous numbers. There are

over 5,000 of them; there may be many more—I have forgotten. They are working, regulated by the Department of Commerce, and are getting a lot of fun out of it, developing some operators and possibly some inventors; we can not tell.

Seventh is the Government station operated by any department of the Government.

The third section looks out for the interstate-commerce provision of the Constitution.

Section 4 requires a license for the station. That is in the old bill. It is also based on the London convention.

Section 5, based on the London convention, requires that the Government shall approve the rates to be charged by licensed stations. That is naturally a function of the Department of Commerce.

The second paragraph of section 5 is a very important one to the Navy Department.

Mr. HARDY. Do you think that section 5, the first paragraph of it, is ample to give the Government complete control over rates?

Commander TODD. Yes, sir; authority to approve rates. By the London convention each Government approves the rates of its stations, and the Secretary of Commerce is the one authorized in the act now in force, as also in this bill to enforce the radio laws of the country as far as commercial interests are concerned.

Mr. HARDY. This gives him the right to approve, but does not give him the right to fix any rates?

Commander TODD. That is it, sir. That possibly amounts to the same thing, and at present that is what the Department of Commerce is doing.

Mr. HARDY. They do fix them?

Commander TODD. Yes. A company wanting a license states the rates they propose to charge, and the Department of Commerce issues the license in accordance with that proposal.

Mr. HARDY. That would be all right as long as the rates proposed were approved, and there would be no trouble because both the Government and the private owner would act in cooperation.

Commander TODD. Yes.

Mr. HARDY. But suppose the Government found some rates were improperly high? Has there ever been a case where the Government has undertaken to reduce the rates or to fix the rates by Government authority, contrary to the will of the owner?

Commander TODD. I would rather leave that for Mr. Chamberlain, who has that perfectly in hand.

Mr. EDMONDS. Is it true that the Government has the power to withhold a license?

Commander TODD. Not at present; no, sir.

Mr. EDMONDS. Or to withdraw the license?

Commander TODD. The Department of Commerce can withdraw the license for failure to observe the regulations or provisions of the act now in force.

Mr. EDMONDS. Then, in case the man did not observe the rate, he could withdraw the license, could he not?

Commander TODD. Yes, sir; if they were the rates once fixed. If the Department of Commerce once approved the rates and he attempted to raise them or even to lower them without approval, he

would be disobeying one of the regulations of the Department of Commerce and would be subject to a fine or a penalty or the revocation of the license, as provided by the act now in force.

At the bottom of page 5 the second paragraph of this section 5 is one of great interest to the Navy and will be the cause of considerable discussion before your committee. It has to do with the opening of Government stations to commercial business. There are now 23 Government stations of the Navy Department and several of the War Department open to commercial business; I think there are 7, 8, or 9 of the War Department stations which are open to commercial business. They work in the same way that the commercial radio companies are doing—communicating with the ships of the commercial companies and with the ships of all nations—and anybody who wishes to send a radiogram through those stations may do so; and they do that in addition to Government work. Wherever the Government work is heavy, certain stations handle it and certain other stations handle the commercial business. By the act now in force, approved in 1912, the Navy Department was authorized to open its coastal stations to commercial business where a commercial radio company did not maintain a full schedule, operating 24 hours of day; that is, where the commercial companies were not prepared to handle this work, the naval stations were allowed to do so. Also at certain strategic points, which you might call the frontier stations of the Navy—such as Key West, San Juan, Tatoosh Island, North Head, and San Diego, and the Alaska stations—the Navy Department was authorized to handle commercial business in any event. We have been doing that for four years now, and we think very successfully.

We have accounts with every department of the Government and with many of the bureaus of those departments, on account of the land line transmission involved. The Government messages carry no charge as far as the radio is concerned, but those radiograms must reach the radio station through the land lines or be delivered to destination by the land lines; and that involves accounts not only with the Western Union, the Postal, and all cable companies, but with the departments concerned for that land line transmission. We have accounts with every radio operating company, either those that have shore stations or those that have ships, or both. If a man-of-war has a commercial message from any member of the crew it must be sent to the nearest station; if that happens to be a commercial station it is sent through that station; or if a naval station open to commercial business is nearest, it is sent through the naval station, in the same way that the merchant ships send messages. They must, by the London Convention, be sent through the nearest coastal station so that they will not have to use high power to reach over to a distant station and thereby cause interference, which is a very wide subject.

We are now handling considerable commercial business. By "we" I mean the Naval Radio Service. We are handling the commercial business at many points on the coast, but do not do so north of Charleston, S. C., on account of the provisions in the present act, in that the commercial companies all maintain a full 24-hour schedule at strategic points north of Charleston. I mean "strategic" from a radio point of view. The opening of naval stations north of Charleston should be read in conjunction with the offer to buy the coastal

stations of commercial companies, as sounding the note of Government ownership of all such coast stations. It has been announced very definitely that the operation of coast stations as such is not a paying venture; that the stations, in other words, do not pay for themselves and that the money in the business comes from the monopoly of communication in any one part of the world, or all over a country where it can be obtained.

In the early days commercial companies one after the other started to get this monopoly. They wanted to get it through operating efficiency or through patents or through whatnot; and they have tried, in one place one company, another place another company, and sometimes both, and sometimes two or three companies have tried, to get this monopoly, and the confusion has been very great. The companies have sued one another and have tried to run one another out of business in one way and another. They have combined against one another and made new alliances. It is rather kaleidoscopic, and the same thing is going on now. We do not know where the commercial companies stand, whether they stand on their own feet or have alliances with another one. The upshot is that no one has been able to get this monopoly.

I do not know that it can be shown that the operation of shore stations does not pay, but from our experience the indications are very strong they can not pay. And ultimately I see—and I am talking for the Navy Department—the commercial stations withdrawing from the field because of this failure to make the operation of shore stations pay, especially if this bill goes through in this form, containing this measure. They can not compete with the Government. There is a monopoly right there, backed by tremendous capital, and the Government stations are furnished, through the liberality of Congress, with the best apparatus, and must take over the whole field in the end.

Mr. EDMONDS. Does the Government pay a royalty for the use of this patented apparatus?

Commander TODD. I can not answer that very definitely. I can say that we purchase the apparatus from the companies that offer it; but the Navy Department, for example, is not in a position to decide on the question of patent rights. And where there is a dispute the people who undertake to furnish the apparatus to the Government must fight it out among themselves or the Government may be sued by the party whose devices are used. The result is that the Government is now being sued by one of the commercial companies for the infringement of patent; that is, for buying apparatus from one of the companies which they claim have infringed their patents.

Mr. EDMONDS. The commercial companies and the Government are both on the same basis in using this apparatus?

Commander TODD. Yes, sir. There is no special protection to the Government. The Government may be sued in the Court of Claims, and is now being sued, as I said.

Mr. EDMONDS. I mean in the use of apparatus also, that the commercial company can buy the apparatus on equal terms?

Commander TODD. Yes, sir. Except that, generally, the Government has to pay more than any commercial company for the same apparatus.

Mr. EDMONDS. The Government does not make this apparatus, without paying any royalty or anything to the patenting companies?

Commander TODD. The Government does make some apparatus, sir. But I will have to leave it for some one familiar with that feature to state whether or not the apparatus manufactured by the Government does infringe any patents or whether or not the Government has made arrangement with those companies beforehand.

Mr. EDMONDS. Is the Government open to suit for infringement for use of a patent?

Commander TODD. Yes, sir; we are being sued now. All the departments of the Government that use radio apparatus are being sued. I think the amount is a million dollars.

The necessity for this measure, the Government ownership features, I should like to cover more fully later on and go on with the bill. This item would be a long step toward Government ownership; and I hope this item will be supplemented by others that will bring Government ownership very definitely and positively within a reasonable time.

The CHAIRMAN. What item is that to which you refer?

Commander TODD. This second paragraph of section 5, at the bottom of page 5.

Mr. HARDY. That paragraph brings out the fact, and your testimony on it, that this intermingling of Government and private ownership of the radio or operation produces infinite confusion of accounts and everything else connected with the service.

Commander TODD. Not accounts. The accounting is done on a very satisfactory basis. Our relations with commercial companies are very intricate. We are operating side by side with them, the commercial stations handling—

Mr. HARDY. I used the word "confusion" when I should have used the word "intricate."

Commander TODD. Intricate, yes.

Mr. HARDY. Of course if the accounts are kept straight there is no confusion, but it seems there is an intermingling of a thousand threads of cross currents.

Commander TODD. Yes, sir.

Mr. HARDY. Between these two different services in the same field; is not that the fact?

Commander TODD. Yes, sir; and interference and great duplication of effort, and sometimes what we call "fighting for the air," by the operators getting into aerial quarrels.

Mr. HARDY. I am talking simply about the fact of private ownership and Government ownership occupying or attempting to occupy the same field and attempting to operate exactly the same service.

Commander TODD. Yes, sir.

Mr. HARDY. Crossing at all times, at all angles?

Commander TODD. Yes, sir.

Mr. HARDY. If it were possible to place it in one control or the other, without engendering monopoly that would be oppressive, it would certainly be better than having these diverse controls?

Commander TODD. Yes, sir. If that point is strongly in the minds of everybody present, there is not much more to be said along those lines.

Mr. HARDY. That is what seemed to me your testimony on this part of the bill was likely to impress and what I gathered from it.

Commander TODD. Yes, sir; but I shall like further on to make that very much stronger and show a number of reasons why these two systems should not be operating side by side where there is this duplication of effort.

Mr. KINCHELOE. Would not complete Government ownership put the commercial companies out of business absolutely?

Commander TODD. No, sir. The only intent of this provision is to take from them the shore end of commercial communication. They still have the very broad field of development and manufacture of apparatus and selling to the steamship lines, selling to the Navy, furnishing apparatus and operators to the merchant ships on a rental basis, and selling to foreign governments.

Mr. KINCHELOE. Practically the only right they would have, then, would be to sell their discoveries and their products?

Commander TODD. To manufacture and sell apparatus, and operate it on ships.

Mr. KINCHELOE. Yes.

Mr. EDMONDS. As far as the present development by commercial companies engaged in radio telegraphy is concerned, it would put them out of business eventually?

Commander TODD. Yes, sir; except for ships, and for sale of apparatus.

Mr. EDMONDS. Of course, I mean as far as their shore business is concerned.

Commander TODD. Yes, sir.

Mr. EDMONDS. They would not be able to run their stations in competition with the Government after the Government had once furnished and finished a complete line of radio apparatus located in favorable locations?

Commander TODD. The Government has its own stations now. It does not propose any new stations except such as may be necessary in special cases and for military purposes. We are constantly improving, but we have the stations there now. What we are asking is for authority to open them up, and it is suggesting Government ownership in a way without saying it.

Mr. EDMONDS. Would it not have a very serious affect on the commercial cable companies' receipts from the radio business?

Commander TODD. No, sir. The overseas work is still young and there is not much competition yet. A great deal of competition is proposed. High-power stations, of which there are eight in this country already (a number of others proposed), work overseas in competition with the cables. And there will be money in that. And if they could work without interfering with the Government's high-power stations, in all circumstances, it would work all right. The inventors and scientists are promising us immunity from this interference, promising us more communication in a given area (and they are succeeding to some extent—the apparatus is very much improved), but we are still far from getting so that we can have a great number of communications. The field is limited, and for that reason they can not work many high-power stations without actual interference. That is the same broad subject, more can work when they are carefully organized as part of one system.

I should like to say here that our relations with the commercial companies are rather involved. We operate side by side with them and interfere with and worry each other. We handle accounts with them with the greatest smoothness and satisfaction.

Mr. EDMONDS. You are talking about commercial wireless companies?

Commander TODD. Yes, sir.

Mr. EDMONDS. I thought you were speaking about the commercial cable companies.

Commander TODD. No, sir; our relations with them are also very satisfactory, and with the Western Union and Postal.

We are urging commercial radio companies to manufacture apparatus and sell it to the Government. The Government has to pay good prices, because the field is limited. On the other hand, they are suing us for breach of patent, for buying apparatus other than theirs. So that the whole situation is extremely complicated, and, as other officers of the Government and representatives of commercial concerns come before you, the situation will look at times very confusing.

The last paragraph of section 5 simply prevents the extension of the commercial systems to United States territory other than that already covered by them. In the places mentioned, no more stations can be erected than are already there. The Navy Department has stations in all those places. The Canal Zone is well covered. The West India Islands have no commercial radio stations except one on the island of Porto Rico, and a fine one on Swan Island in the Caribbean. On the Pacific Ocean, the wording "West of the 161st meridian," and so on, means anywhere in the western part of the Pacific Ocean except in Hawaii. Hawaii is well covered already by an existing system, where, on account of cheapness, they use radio between the islands instead of laying cables.

The CHAIRMAN. How many companies have commercial wireless stations on the islands?

Commander TODD. Three, sir; the Mutual Telephone Co., which is a local system, connecting up the islands and communicating with ships; the Marconi Co. has communication with the California coast and with Japan through a Japanese Government station, and the Federal Telegraph Co., which has a large station for communicating with the California coast. The latter is the oldest, fairly reliable overseas transmission we know of. And the Navy will have completed, in this calendar year, a very high power station on the same small island with these three other systems.

The CHAIRMAN. They are all on the island of Oahu?

Commander TODD. The Mutual Telephone Company spreads all over the islands, but its principal station is on the island of Oahu; the Federal Station at Heeia Point; and the Kahuku Station of the Marconi Company. The last two are high-power stations.

Mr. EDMONDS. Do I understand that this puts the Marconi company out of business?

Commander TODD. No, sir.

Mr. EDMONDS. It controls the land line, though?

Commander TODD. Yes, sir; in a way. It permits all radio stations of the Navy to handle the shore end of commercial ship to shore communication.

Mr. EDMONDS. And does it leave open the number of small islands on the Pacific?

Commander TODD. No, sir; the Government will furnish such radio stations as may be necessary there. Samoa is covered. We are putting up a medium power station there. We have had a low-power station there for years. Guam is covered in the same way, and the Philippines is covered by the Philippines Government, by the War Department, and by ourselves. It practically means no commercial station in Guam, nor in that portion of the Hawaiian group west of the main group of islands, nor in American Samoa.

Mr. EDMONDS. It does not say that.

Commander TODD. The geographic limits marked out—west of the one hundred and sixty-first meridian of longitude west of Greenwich and south of the fortieth parallel of north latitude—covers that, sir. These limits exclude Alaska and the eight principal islands of the Hawaiian group.

Mr. EDMONDS. I thought you mentioned that exception because you had the exception of Porto Rico and Swan Island right ahead of it there.

Commander TODD. Other than Porto Rico and Swan Islands refers to the West Indies.

Mr. HADLEY. You say this limitation excludes Alaska?

Commander TODD. Yes, sir.

Mr. HADLEY. If the ultimate design is, and I understand it to be from your statement, to effect a Government monopoly absolutely, what is the purpose of making any exceptions now at all?

Commander TODD. As I said in the beginning, we, the Navy Department, and the War, Commerce, Labor, and Treasury Departments, have gone beyond this bill in advocating Government ownership. This suggests, in a very mild way, Government ownership. Now we feel strong enough to come out flatfooted and say that we believe in total enforced Government ownership, with the result that these exceptions should apply only until exceptions are all eliminated by purchase of the privately owned stations in the excepted localities. The stations in Alaska should be bought; those in Hawaii and those in the West Indies should be bought, very unquestionably and positively, as an urgent military measure of prime importance.

Mr. HADLEY. I understand that you are advocating the amendment of this bill so as to make that effective now?

Commander TODD. Yes, sir; I hope to see the bill amended to effect a complete Government monopoly within two years.

Mr. HADLEY. I want to get the theory of your statement, because it is not consistent with the bill, and I want to know just what you are coming to, as I may not be able to hear all of your statement.

Commander TODD. Yes, sir.

Mr. HARDY. As I understand your presentation of this last section here, it now embraces all territory not already occupied by commercial companies?

Commander TODD. Yes, sir.

Mr. HARDY. And prohibits the commercial entry, or the entry of the commercial companies, into that at present unoccupied territory?

Commander TODD. Yes, sir. They are ordinarily places that would not be profitable for commercial companies to extend into, except, possibly, for expensive, high-power stations; and the Government has its stations built or building at those places now. In case the Danish West Indies are acquired by this Government, one station for communicating with ships might be made profitable in time.

Mr. HARDY. This bill, however, as drawn is drawn so as not to affect the vested rights of companies in those places?

Commander TODD. Commercial companies have not extended into the places mentioned. Practically only the Atlantic seaboard north of Charleston is affected. We are handling commercial work already, by direct authority of Congress, at practically all other parts of the world owned by the United States.

Mr. HARDY. And what is the reason for those exceptions?

Commander TODD. Privately owned stations are already working in Porto Rico, in the Swan Islands, and in Hawaii. None of them are forced out of business by this bill. They may offer their stations for Government purchase within five years, as shown further on, but they are not required to sell out, or are they given any definite date after which they must cease to work.

Mr. EDMONDS. You mean before long they, no doubt, will offer their stations after this is in operation?

Mr. BYRNES. That is the object of it.

Commander TODD. That is, except for the high-power stations. I think they will favor a bill for the purchase of the coast stations.

Mr. HADLEY. Has any estimate been made of what it would cost to purchase those coast stations?

Commander TODD. Yes, sir. Naturally, it must be rough, because they do not give us any insight. We must estimate, as it were, from the outside. We have seen the inside of some of those stations.

Mr. HADLEY. Are you able, offhand, to give a rough estimate?

Commander TODD. For the coast stations, I should say, \$400,000. They are ordinarily not of a very substantial character. The average coast station has not the latest apparatus, has not high masts, is not prepared to stand tropical storms, and is liable to be put out of business. It has a limited range. It did not cost much in the first place. Most of them were put up originally for advertising purposes, to sell stock, and they do not represent much capital. Their earning power may be a question of investigation; but the station itself—the physical value of the station—is not much.

Mr. KINCHELOE. What per cent of the number and physical value of the radio stations is owned by the Government and what per cent by commercial enterprises now?

Commander TODD. In volume of business?

Mr. KINCHELOE. I mean of the number of stations and the value of them; not the business they are doing.

Commander TODD. I should have to estimate that, sir. But I should say that the stations operated by the Government—not for commercial purposes but of all kinds, do you mean?

Mr. KINCHELOE. Yes.

Commander TODD. I should say they are worth, at the very lowest, ten times as much as all the commercial stations in the country; and when we have the high-power stations working it will, naturally,

amount to very much more. I think that is a very conservative estimate, indeed.

Mr. EDMONDS. Your high-power stations cost about \$200,000 each, do they not, installed?

Commander TODD. They are costing more and more. The high cost of living has struck that branch, too.

Mr. EDMONDS. I mean we are appropriating \$1,000,000 to construct five stations, which would make the average cost of the five \$200,000 each?

Commander TODD. Yes; but they have been found to be costing more, and you are appropriating more money.

Mr. EDMONDS. That was two years ago?

Commander TODD. Yes, sir. I believe the station at Arlington over here cost around \$210,000.

Mr. BYRNES. The object of the bill is to establish a Government monopoly of this business, is it not?

Commander TODD. A monopoly of the shore end; not the ships.

Mr. BYRNES. The commercial end of it?

Commander TODD. Yes, sir.

Mr. BYRNES. To establish that either by purchasing from those who are now willing to sell or by our going into the business to force those not now willing to sell to acquiesce in that sale in a very short time, so that we will secure a monopoly of this commercial business? That is the way?

Commander TODD. Yes, sir; but I hope the committee will go beyond this bill and approve such provisions as will require the commercial concerns to sell out after a given time; to set a date, no matter how distant, as the committee may see fit, beyond which all stations of this character will not be licensed.

Mr. BYRNES. If that is your hope, can you not tell us what it will cost the United States Government to purchase these stations?

Commander TODD. I can only estimate, as I said.

Mr. BYRNES. What is your estimate of the cost to the Government of the purchase of those commercial stations?

Commander TODD. For the coast stations, \$400,000; for the eight high-power stations, over \$4,000,000, sir.

Mr. BYRNES. In all?

Commander TODD. For the eight high-power stations.

Mr. BYRNES. That is for the high-power stations?

Commander TODD. Yes, sir.

Mr. BYRNES. And therefore it would be at least four and a half million dollars?

Commander TODD. Yes, sir. That is very rough, indeed. For the high-power stations I have given a high estimate.

The CHAIRMAN. Are they worth more, on the average, than the station out here at Arlington?

Commander TODD. The average is higher.

Mr. BYRNES. For us to establish this monopoly, then, it means an expenditure of \$5,000,000?

Commander TODD. Yes, sir; at the outside.

Mr. BYRNES. At the outside?

Commander TODD. They would have to be appraised by experts to get a reasonable valuation.

Mr. HADLEY. In this estimate you are only estimating the value of the physical properties, are you not?

Commander TODD. No, sir; the good will, too.

Mr. HADLEY. And the rights?

Commander TODD. Not what the owners may claim are their earning powers, but a valuation on which somebody would ultimately be able to decide to be reasonable. The land values would require special investigation. If my estimates should prove to be low, it would be on account of my failure to appreciate the values of sites on which the high-power stations have been erected.

Mr. CHAMBERLAIN. To be determined by investigation?

Commander TODD. Yes, sir.

Mr. BYRNES. Do you mean this \$5,000,000 would put out of business all commercial stations, or would there be any exceptions?

Commander TODD. No exceptions. They would all be purchased.

Mr. EDMONDS. You only mean the coastal stations?

Commander TODD. No, sir; the high-power stations also.

Mr. EDMONDS. There is a high-power station in this country now?

Commander TODD. Yes; eight—two in Hawaii and six in this country.

Mr. BYRNES. That is only for the coastal stations?

Commander TODD. Plus the high-power stations, plus some that communicate overland.

Mr. BYRNES. What was the exception—I did not at first understand—about ships?

Commander TODD. We do not intend to interfere with the commercial working of ships, but to increase and facilitate their business in every way.

Mr. BYRNES. That is, between ships, or what?

Commander TODD. We have no interest in communication between ships, or between ship and shore, except in the shore end; that is, the commercial companies will still own and operate apparatus on ships. The working of ships among themselves, however, as well as their working with the shore, would be much improved if only Government stations were working.

Mr. BYRNES. But they would have to communicate with the Government stations on shore.

Commander TODD. Yes, sir; we claim to their great advantage.

Mr. CHAMBERLAIN. But you have no interest offshore?

Commander TODD. We have no interest offshore, except as far as Government vessels are concerned.

Mr. HADLEY. The Government would control the private operation of the ship indirectly by virtue of its control of the shore stations?

Commander TODD. That is well regulated already, sir. That is in accordance with the London convention; the international convention covers the commercial working of all ships of all nationalities.

Mr. EDMONDS. Is that done by the countries in the convention?

Commander TODD. All the principal countries of the world, sir. I do not know the present details, but I think all those that were represented at the conference have ratified the convention.

Mr. EDMONDS. That takes in all of the principal countries?

Commander TODD. Yes, sir.

Mr. EDMONDS. Does it take in Japan?

Commander TODD. Yes, sir; and the South American countries and nearly every one of the European countries. A copy of the convention would show the signatory powers.

Mr. HARDY. Along that line Mr. Byrnes was asking about, this radio business is in its infancy, and if allowed by private enterprise to be continued for another 10 years, that \$5,000,000 would likely grow to \$20,000,000 that the Government would have to pay out at the end of 10 years from now?

Commander TODD. Oh, yes; because the number of high-power stations will surely increase after attention has been attracted to the success of the German high-power stations in this country.

Mr. HARDY. The point I am getting at is this: That ultimately, if the United States is going to have a monopoly in this business, the quicker she gets it the more economical it will be.

Commander TODD. This should have been done years ago. The foreign Governments, many of them, were farsighted enough to establish a monopoly from the first.

Mr. HARDY. Do you know what foreign Governments have established such a monopoly?

Commander TODD. I could name some of the principal ones, but it would be subject to correction. Germany, of course, France—

Mr. HARDY. I would like, when you correct your testimony, to have you put that in as best you can.

Commander TODD. I will try to get that, sir. I do not know now just where I am going to get it; but I think, later on, some gentlemen will appear who will have that at their fingers' ends. But in the European countries, where the Government does not retain a complete monopoly, the commercial stations are regulated so carefully that it is practically Government ownership. It amounts to the same thing.

Mr. KINCHELOE. If I understand you, your paramount reason for wanting Government monopoly is in the interest of national defense?

Commander TODD. Exactly so; that is the basis.

Mr. KINCHELOE. Have you any other reason except that?

Commander TODD. The question of mutual interference between the stations, which limits not only the amount of work which the Government can do but also that of the commercial people, the interference between the commercial people themselves, and the needless duplication of capital and effort.

Mr. KINCHELOE. Does that destroy the efficiency of the service, too—these conflicts?

Commander TODD. It does, sir. It destroys, to some extent, their efficiency and ours.

Mr. HARDY. There are two systems operating over one track without any central control?

Commander TODD. That is it, sir; and the best results for the Nation as a whole could be obtained only by establishing one management.

Mr. BRUCKNER. The wire is crossed, in other words?

Commander TODD. Yes, sir; you have some gentlemen here to-day who will probably tell you positively that with their devices it is quite possible to have as many conversations as there are telephone wires, or something like that. They have been saying that since

about 1909, but they have not yet been able to demonstrate the practicability of their devices. When they do, the Navy must have them. Still we have the interference; still these inventions are just about to be given to us. We get some and try them, and we still labor under the same difficulties to a great extent. Of course, there is a steady advance in efficiency of apparatus, of which radio communication does not get full advantage because commercial ships and stations do not get them promptly. The Government stations are always ahead.

The CHAIRMAN. As I understand it, your viewpoint is this: The Navy Department, or the Government through the Navy Department, has already established wireless stations at all strategical points on our coasts and in our insular possessions, or is doing so. Those stations now can not only perform these services incident to the Navy, but all these services at a minimum cost to the public, and at far less investment of capital than by having this multiplication of service by different commercial companies. In other words, you can not dispense with the naval stations; and if we extend them and develop them, the same stations, apparatus, and operators can operate these other services as well?

Commander TODD. Yes, sir. Furthermore, the naval stations would be able to handle all Government business to better advantage. I do not say naval business only. That would come in strongly in the event we should, unfortunately, have a war. But the Government business as a whole, the business of all departments of the Government, would be handled far more efficiently if the Government stations handled all the commercial business, on account of elimination of interference and on account of the fact that the station that handles the greatest amount of business has the best operators. High operating efficiency comes only from constant operation, and the Government would profit very much along this line.

Mr. EDMONDS. Let me ask you a practical question: If war were declared by an Asiatic country against this country to-day, how would you get information into the Island of Guam?

Commander TODD. If war were declared now?

Mr. EDMONDS. Yes, sir.

Commander TODD. By Pacific cable.

Mr. EDMONDS. You would use the commercial cable?

Commander TODD. Yes, sir.

Mr. EDMONDS. You could not use the wireless for communicating with Guam?

Commander TODD. We expect to communicate with Guam by wireless in the near future.

Mr. EDMONDS. I thought the wireless at Guam only had a radius of about 600 miles.

Commander TODD. Yes, sir; it is very limited at present; a new station is being built. We expect this year to have it in communication with Pearl Harbor, where we have a large station now being erected, and also with Cavite.

Mr. EDMONDS. You are putting a larger one there, too?

Commander TODD. Yes, sir; a new station, which we have erected and equipped with the best apparatus that we can get at this time.

The CHAIRMAN. At that point, as a necessary step, the Govern-

ment would be compelled to take over the Marconi and Federal stations on the Island of Oahu, would they not?

Commander TODD. Yes, sir; to take over the stations on the Island of Oahu.

The CHAIRMAN. You would have to take them over as a military necessity in the event of a war?

Commander TODD. Yes; we are allowed to do that now, under the present act.

Mr. BYRNES. Putting those commercial stations out of business will have what effect, if any, upon the service on ships of the commercial companies that have stations upon ships, which you referred to a few moments ago?

Commander TODD. The effect would be smoothness of working, a quicker handling of their traffic on account of noninterference from a competing system. They would know that they were sending their message to a certain management, to a Government station, and the messages would be handled in a certain definite way, their accounts would come in a form they are used to, and there would be no question of who would be responsible for delays or errors.

Mr. BYRNES. To whom do they now send their messages?

Commander TODD. Partly to our Government stations and partly to commercial stations, depending upon where they are.

Mr. BYRNES. The same company is also interested in a coast station and the service upon the ship, is it not?

Commander TODD. Yes, sir; in some cases, and they work the two in combination.

Mr. BYRNES. Now, if you put their coastal station out of business, will it not mean they will be running at a much greater expense and make that service upon ships more expensive, or will it?

Commander TODD. No, sir; it would have no effect upon the expense of operating a ship, because the Government rates are at present the same as the commercial rates. We have not tried to compete in that way with them in these four years. We do compete in operating efficiency. We have maintained the same rates for uniformity's sake, and we make just as little distinction between a Government station and a commercial station as we can.

Mr. BYRNES. You do not think it would injure the service on the ships at all.

Commander TODD. No, sir; it would improve the service on the ships, because we always have all of our stations fully manned.

Mr. EDMONDS. There are a number of different systems of wireless—the Marconi and other different types of apparatus?

Commander TODD. Different types of apparatus; yes, sir.

Mr. EDMONDS. Do they intercommunicate with each other?

Commander TODD. Yes, sir; except as regards some of the later systems. Not all stations have been fitted to receive what are called "continuous waves." That is something that is being rapidly developed, and not all commercial stations and ships are fitted to receive these waves. But in all other respects any station can receive messages from any ship. All naval ships and stations receive continuous waves, and the principal ones are equipped to send, also.

Mr. KINCHELOE. You said a while ago, in answer to my question, that your prime reason for wanting a Government monopoly was for the national defense?

Commander TODD. Yes, sir.

Mr. KINCHELOE. I take it, of course, you mean to accomplish efficiency and secrecy at the same time if you have Government control.

Commander TODD. Yes, sir.

Mr. KINCHELOE. Have you a right now, under the law, in case of war to take over these commercial stations?

Commander TODD. Yes, sir; and what we would really do would be to shut most of them up. We have the Government stations already and we would not have time to work these others into our organization, except a few favorably situated or well equipped for our needs.

Mr. KINCHELOE. I understand that is the purpose in case you had Government monopoly; but I mean, under the law now have you the right in case of war, in this country, to go and take over these commercial stations?

Commander TODD. Yes, sir.

Mr. KINCHELOE. You have that power under the law now?

Commander TODD. We have. The point is this: When war is about to come down upon us it is too late to get any efficiency out of those commercial stations suddenly transferred to Government control.

Mr. KINCHELOE. I understand if war were to be declared, say, tomorrow, under the present law the Government would have the right to take over those commercial stations for the use of the Government?

Commander TODD. Yes, sir; in time of war or public peril.

Mr. EDMONDS. You did take possession of the station at Tuckerton?

Commander TODD. And at Sayville; those two commercial stations.

Mr. EDMONDS. You evidently had the right to do it or you would not have done it.

Commander TODD. Yes, sir.

Mr. HARDY. Do I understand you to say the Government did take over the station at Sayville?

Commander TODD. Yes, sir.

Mr. HARDY. Did it take them over or just put its own agents in to censor the messages? It did not take the stations over, did it?

Commander TODD. Not to the financial benefit of the Government; no sir. We put in our officers and operators. They are now operating those two stations.

Mr. HARDY. In other words, we are running them for the owners?

Commander TODD. Yes; that is it.

Mr. HARDY. So as to censor their performances?

Mr. EDMONDS. I think the former act provides in time of peril that they could be taken over, and as this was a time of peril we took them over.

Mr. HARDY. At any rate, if the Government has not that power, it ought to have it.

Commander TODD. Surely. But we can not take them over to advantage when war is imminent; it is too late. We have the principle that any measure of defense, any such arrangements not made beforehand and in working order when war is imminent, can not be made effective after war is declared, for a long time. It is too late to improvise; there are too many urgent things to do.

Mr. HARDY. Is it your idea that the existence of such means of communication within our country in time of war might be a source of danger to us?

Commander TODD. Undoubtedly a source of danger, sir. Any radio interference whatever would be intolerable. You see the troubles we have had in the questions of neutrality. We are having them now. We are not at war, but we don't know how near we are to it.

Mr. HARDY. If we had a privately owned wireless station of great power in the United States and another one either privately or governmentally owned in some country with which we were at war, that privately owned station might make any character of communication?

Commander TODD. Until we shut the station up or took it over, which we would do very promptly, as a matter of military necessity.

Mr. HARDY. You think in case of war we would have to close all privately owned wireless stations?

Commander TODD. Immediately; yes, sir; and possibly later develop the use of some of them in special circumstances.

Mr. HARDY. Either close them or take them over?

Commander TODD. Yes, sir.

Mr. BURKE. Permit me a question right there: I understood you to say a few moments ago that, in addition to taking over the coast stations, it was the intention under this bill, if it becomes a law, to take over the high-power stations that are now erected and in use in the country?

Commander TODD. Not as the bill reads, sir; but I am hoping the committee will take that under consideration.

Mr. BURKE. I understand. That provision or idea is not incorporated in the present bill, but you suggest that the committee, if it sees fit, incorporate that idea?

Commander TODD. Exactly, sir. In accordance with the strong recommendations of the heads of at least five executive departments.

Mr. BURKE. That would answer Brother Hardy's question: If this monopoly is established, there won't be any stations such as you suggested?

Mr. HARDY. I was just suggesting against any such stations being allowed to be established.

Mr. BURKE. If this bill becomes a law, with the additional idea, there won't exist any except Government stations.

The CHAIRMAN. Proceed.

Commander TODD. I will not take the time of the committee much longer. I should like to go very rapidly over the rest of the bill. Section 6 is another part of the mild Government-ownership suggestions in this bill; that is, any commercial company may sell to the Government, through the Navy Department, any coastal stations now in operation that the owner may desire to sell; that is, within five years they may offer those to the Government, but there is no compulsion there at all.

Mr. BURKE. If your idea is incorporated into this bill—of the Government taking all of these stations over—it will not be necessary to have that provision, will it, which is contained in section 6?

Commander TODD. No, sir. If the Secretary of the Navy's letter, Judge, could be read, it would be found to recommend that this section 6 be altered along certain lines. I think it is rather clearly set out in the Secretary's letter. Could that letter be read, sir?

The CHAIRMAN. It will be put in the record; yes.

Commander TODD. I hoped it might be read now.

Mr. BURKE. Does the Secretary in that letter suggest the time in which the Government shall or must take them over?

Commander TODD. Yes, sir; two years. Section 7 prevents the foreign ownership of stations in this country. We have had this unfortunate experience of the Sayville and Tuckerton stations, and this section 7 is intended to prevent a repetition of such a proceeding.

Mr. BURKE. Commander, for my information, and perhaps that of some of the members of the committee, the Sayville station is owned by Germany, is it not?

Commander TODD. It is owned by the Atlantic Communication Co., sir.

Mr. BURKE. Is that a foreign corporation?

Commander TODD. No, sir; it is an American corporation, but foreign owned.

Mr. BURKE. What rights did Germany have in and to that station. or is that station connected with some other station in Germany and used between Germany and this country?

Commander TODD. It is now working at very high pressure between Sayville and Berlin (Nauen).

Mr. EDMONDS. So far as I am concerned, if this bill goes through, permitting a foreign government to own a portion of the stock in those companies, I would not myself approve of having in the bill a provision that a foreign government could own one-third of the stock of a company. I do not think they have any right to do it.

The CHAIRMAN. Under our law the corporation would be an American citizen technically, and yet all of the stock of that corporation be owned by foreigners.

Mr. EDMONDS. But here is a section that gives a foreign government, the representative of the government, a right to own one-third of the stock.

The CHAIRMAN. So far as we are concerned, we have no law forbidding that; but in time of war I assume the Government would take over and control that station and, so far as that is concerned, the corresponding station in Germany and, indirectly if not directly, control the one here.

As I understand your statement, since the war in Europe, in order that we might protect ourselves as a neutral and not become involved in the controversy in Europe, the Government has found it necessary to take over the control of the Sayville station to all intents and purposes?

Commander TODD. Yes, sir.

The CHAIRMAN. And now the German Government for the same reason, it would seem to me, would take over the control of the corresponding station in Germany.

Commander TODD. Yes, sir; it is run directly by the German post office.

The CHAIRMAN. It would be a very violent assumption to say they did not do it. It is both in their interest to do it and a logical thing to do.

Mr. EDMONDS. I do not think we should allow a foreign government or representative of a foreign government to have one-third of the stock in any wireless company in this country. I do not think you do, either, do you?

Commander TODD. I do not know how to control it. The stock can be sold anywhere.

Mr. EDMONDS. We could not control it, but it would have a certain influence on the other stockholders when one block of stock or one-third of the stock was owned by one party?

Commander TODD. Yes, sir.

Mr. BYRNES. Suppose the individuals who control—the stockholders—were individuals the Government could control, they would get around it?

Mr. EDMONDS. You mean that if the individual members, say Frenchmen, controlled one-third of the stock?

Mr. BYRNES. You mean not to have individuals do it, much less the Government?

Mr. EDMONDS. As a Government, I do not think the Government should have control of any wireless station over here, or even a one-third interest in it.

Mr. BYRNES. They could do it through individuals, if not through the Government itself, if they wanted to. It would be hard to stop them.

Mr. EDMONDS. Possibly so; but at the same time it would not open up complications with the Government, if it happened to be taken over at any time, on account of having a one-third interest. Individuals you could handle, whereas a government would be a little different proposition.

Commander TODD. One paragraph in here, on page 8, section 7, prevents putting up a station where it will interfere seriously with existing stations, whether privately owned or Government owned.

Section 8 concerns the application for licenses and furnishes a penalty for making untrue statements in the application.

Section 9 gives the form and detail of contents of the license for a station.

Section 10 covers the revocation of a license by the Secretary of Commerce for failure to carry out the conditions named in the license, provides access to such books and records as will allow the Secretary of Commerce to judge of the ownership, and so on.

Section 11 provides for licenses for operators, with provisions to cover emergency cases.

The CHAIRMAN. I believe it provides that none but American citizens shall be operators, except in cases of emergency when others may be employed temporarily.

Commander TODD. That comes later on, sir. It is page 14, line 15, "Except for the operation of a station on shipboard, an operator's license shall not be granted to any alien, nor shall such a license be granted to a representative of a foreign government for the operation of any radio station."

From the Navy Department point of view, that "except for the operation of a station on shipboard," should be omitted. It is on account of the possibility of unneutral service.

Mr. BRUCKNER. Has nobody any means of telling what is being sent by an operator?

Commander TODD. Yes, sir; by themselves listening in with a receiver.

Mr. BRUCKNER. But the captain does not know, and has no way of knowing?

Commander TODD. No, sir; he must also be an operator to be able to understand the signals. If the captain were upon the bridge and had a telephone to his ear and a little receiver he would know what his own operator was doing. But the foreign operator could, having sympathies on account of his nationality, endanger the vessel and the people on board without the knowledge of the captain, and in that way possibly bring about international complications which would be embarrassing.

Mr. BURKE. Just one question. The provision commencing with the word "nor," line 17, page 14, and running to line 19, including the word "station"—is not that intended to prevent just such a condition as the Government found at the Sayville Station at the time it took it over?

Commander TODD. It could not be shown that the owners or the head men of that company were actually representatives of a foreign Government; but there was so much doubt about it that there was a question in the minds of the Department of Commerce whether or not that station should be licensed.

Mr. BURKE. It seems to me the newspapers stated it was taken over because it was being managed by representatives of the German Government, or citizens of the German Government.

Commander TODD. Practically so; but I can not say positively they were actually German citizens. There were Germans there, but the head men were naturalized American citizens, I am rather sure.

The operator's license, the form of it, and the penalty are contained in section 13.

Mr. HARDY. Did I understand you to say, on section 12, that those lines 15 and 16 ought to be eliminated so that there ought not to be any license—

Commander TODD. Yes, sir; that is the Navy Department's view of it. The committee did not take that view. Should the suggested change be made there should be incorporated in there a provision that in emergencies a ship might employ an alien operator. An American ship might be in a foreign port and the operator might die or desert. The law requires ships to have apparatus and the law requires them to have operators, and in emergencies a ship should be allowed temporarily to employ an alien operator; but no American ship should sail from a United States port without American operators.

Section 14 is intended to cover the neutrality of the United States in just such circumstances as we are in at present, and to cover an urgent necessity for preventing information of great military value going out in case this country should be on the eve of war or threatened with a war. Since commercial radio signals can be read by anybody having a receiver, ordinary commercial messages would contain information of vast importance to an enemy about to strike, especially in the case of a maritime nation, which would have its cruisers on the ocean. The movements of merchant vessels flying the American flag would then be of obvious interest to them. Time would be most precious, and a little delay in getting information or failure to get information would save many a ship. And the idea of

this section is to put in the hands of the President, as Commander in Chief of the Army and Navy, the power to prevent the prejudicing of our cause in the twilight period just preceding the war, especially in these days when wars break out with such surprising suddenness.

Page 16, paragraph (b), the President may cause the temporary closing of any radio station, or the temporary removal of apparatus, upon just compensation to the owners. In case we do not have Government ownership, that would permit the President to act in the way he has done in the case of the Sayville and Tuckerton stations. If he considered a station dangerous to the peace and good order of the United States, he might take it over and operate it for five months at a time and compensate the owners for taking it away from them temporarily.

The CHAIRMAN. I do not imagine anybody would object to that—no American citizen.

Commander TODD. Section (c) makes stations liable to inspection at all times by the Department of Commerce.

Section 15 (a) has to do with malicious interferences. A good many of these sections are contained in former acts or based on the London convention.

(b) Is the secrecy part of the bill and the provisions of the present act has been amplified to allow an operator to furnish the accounting departments or administration of his company with copies of the radiograms. Also, there has been put in an item which strengthens the hold of the master of a ship upon his radio operators, and assists him in protecting the lives for which he is responsible—that is, an operator may show to the master of the ship any radiogram which he intercepts. This would be of especial value in case of conversations between ships containing items of interest in the navigation of the ship. The safety of the ship, passengers, and crew may be furthered by the radio operator coming on the bridge and saying that such and such a ship reported that such a lightship was adrift, or that such a buoy was out, or that there was a derelict in such and such latitude and longitude. Anything that could be drawn down out of the air that would further the safety of a ship and passengers and crew should be made available to the responsible officer. This would also prevent the radio operator from being too independent of the master and too high handed. I have been told that this has occurred in one or two instances.

Mr. BENEDICT. Do all operators use the same code, so that any ship or any nation could read the messages of other ships and other nations?

Commander TODD. Yes, sir; all use the International Morse Code.

Mr. BENEDICT. Is it not possible, in time of war, for one nation to use an entirely different code so that other nations could not read their messages?

Commander TODD. It would be possible, but not practicable or necessary.

Mr. BENEDICT. Would it be hard to install such a system?

Commander TODD. Yes, sir; you would have to train the operators very carefully. We use cipher. We use our regular code book, and in time of war would still further blind the meanings of our signals by cipher. We habitually, in our Government communications, put

what we have to say in code for training the operators to receive it and for training the officers to decipher those messages. Operators get into the habit of receiving words they are more or less familiar with carelessly. They guess at words or fill in the blanks if they miss letters. Receiving a succession of letters and numbers which mean nothing to them requires closer attention and greater accuracy, and fits them for what they would be required to do in time of war. Nothing could be sent in plain language in time of war.

Section 16 gives priority to distress calls, which is part of the present act and the convention.

The second paragraph of section 16 is a requirement of the London convention.

Section 17 concerns safety at sea, except that the second paragraph of 17 has to do with the character of the apparatus, which increases the possibilities of communication in any given area. It is to prevent the worst types of apparatus being used. It is not very restrictive. The technical men present will explain that to the committee at length, if they so desire.

Receiving apparatus is covered in the next paragraph. This is also a very mildly worded measure.

Now we come to the sections that deal with the different classes of stations. Section 18 leaves amateurs just where they now are. The first paragraph is the ordinary boy who puts up a station and gets a license. There is no license required for receiving. The second paragraph keeps boys too close to the Government stations from using too high power. They are restricted a little more than the others, if they happen to be within five miles.

The third paragraph makes provision for a few very special stations that may be of use to the Government at one time or another, or from which the art of radiotelegraphy or other interests may get some use. The Government may, in some way, get some use out of those special amateur stations in cases of floods, etc., and possibly as receiving stations in case of war.

The CHAIRMAN. Did you say there are no further restrictions placed on amateurs in this bill than in the present law?

Commander TODD. No further restrictions. Those restrictions are found to cover the case satisfactorily.

Mr. ROWE. You said it holds them to a lower power, didn't you?

Commander TODD. That was in the other bill; that is not a new restriction. The intention of the committee was to impose no additional restrictions.

Section 19 has to do with the development of the art. That is, the Secretary of Commerce has power to permit tests of any kind, with certain moderate restrictions. The aim has been all through this bill to encourage the development of apparatus. The Government constantly requires apparatus of increased efficiency, and will buy as fast as it is developed. Ships are also improving their apparatus from time to time—commercial ships.

Section 20 has to do with commercial stations; that is, stations that do not communicate with ships, but operate between fixed points where land lines or cables are not practicable, and in other cases compete with land lines and cables. It also covers technical and training school stations, and keeps them from interfering with those wave lengths ordinarily used by the Government as well as

those ordinarily used for commercial purposes between ship and shore.

The CHAIRMAN. Does this wave length limit the distance messages can be sent?

Commander TODD. No, sir; there is no limit on the longer wave lengths. The longer wave lengths are more favorable to distant communication, especially over land. It simply keeps them away from the most important wave lengths, those most useful for communicating between ship and shore. The commercial wave lengths used between ship and shore are laid down in the London convention, and naval messages are sent ordinarily by ships on a wave length within the range reserved by all Governments for Government ship-to-shore work.

The CHAIRMAN. That is, the wave lengths between 600 and 1,600 are reserved for the Government.

Commander TODD. Yes, sir; all Governments reserved that range in the London Convention.

Mr. HARDY. I see you also have a special wave length of 1,800.

Commander TODD. That is also in the London convention.

Mr. HARDY. Why was that special wave length provided?

Commander TODD. Some nations demanded it, because it was found that the Dutch, for instance, were sending messages from their ships in the Mediterranean clear across Europe to a station at Scheveningen, near The Hague; and in the discussion it seemed that there was some need for allowing ships to communicate with a more distant station in its own country rather than to follow the rule of communicating with the nearest shore station. The international arrangement is such that a ship is required to communicate with the nearest station, so that she will not need to use high power for the purpose, and further transmission is arranged for by requiring international telegraphing and cabling arrangements; but this special provision allows a ship to pass over the head of a nearer station when it can be done without interference, to provide communication between ships of a certain nationality and stations belonging to the same nation.

Mr. HARDY. So that private ships may use any wave length over 1,600, except that one of 1,800?

Commander TODD. Yes, sir; they may use that also, but they must use it in strict compliance with the London convention.

Mr. EDMONDS. This is taken from the London convention?

Commander TODD. Yes, sir; directly. The paragraph concerning complaints of interference favors the ship-to-shore work and favors communication between fixed points where land lines and cables do not cover.

Section 21 is from the London convention and deals with the ordinary communication between ship and shore, with an added paragraph for distress purposes, requiring the receiver to be so marked that the operator can quickly turn to 600 meters for receiving distress calls. The receiver must be so marked that the shift from a certain wave length to 600 meters can be very prompt.

Section 22 is a provision of the present act just reprinted.

The second paragraph of 22 is new. It can be shown that a very great amount of interference is caused by ships using their transmitters when they are in harbor. Such use is a very great con-

venience and in an emergency, of course, is very necessary and should be allowed; but ordinarily the ship at sea is the one that should be favored; the ship at sea is the one that should be able to report the time of arrival and ask instructions as to when and where to dock, and so on. The ship in port should put her message in a boat, send it ashore, and from there send it by telephone or telegraph. That regulation need not be applied in all harbors; only where necessary.

Section 23 protects certain very important Government stations from other stations being erected too close to them. It seems that for many years the possibilities of noninterference on account of difference of wave lengths have been extended; that is, the number of communications that may occur in a given area with different wave lengths has increased. But it still remains true that in spite of difference in wave lengths a station sending with power will affect the receiver of another nearby station in spite of a great difference of wave length; that is, in this city, for instance, if a high-power station were put up, Arlington could not receive anything on long waves. It all depends upon the power used and upon nearness, upon efficiency of apparatus, heights of towers, spread of antenna wire, and, of course, the more nearly alike the receiving and sending wave lengths are the more interference. This provision taken from the act now in force protects the important Government stations of the Army and Navy to a slight extent; that is, it keeps commercial stations at least 15 miles away, which is considered enough in these days, as they go to great lengths to choose a site for a radio station, anyway.

Section 24 has to do with the division of time. It is really very unfortunate that we have to ask for a thing so restrictive, but it is a provision that was incorporated in the present act, and should remain in the bill as it stands. In the present act a Government station is allowed 15 minutes out of every hour—the first 15 minutes. That was the utmost we could get the committee and Congress to give us. As a matter of fact, we have not requested an enforcement of that at any place in these four years. Where the pressure was too great we have arranged to do most of the Government business in some other way. We have had to restrict the value of our stations to the Government in one or two places.

In other places we have met with the very cordial cooperation of the commercial stations and have been able to arrange sending schedules, so that when one is receiving the other will not be sending. Those arrangements are sometimes very satisfactory, but unless Government ownership is accomplished the time will come when one station will insist on saying that it has as much right to work as another station. Where interference is greatest there are ordinarily three interests involved, the Navy and two others. We have a situation like that in New Orleans, another one on the west coast, in San Francisco, and are soon to have one in Hawaii. Their interests are involved; but without some special arrangements the stations can not work satisfactorily. All three, or more, stations could send together and all could receive together on different wave lengths. This would make them come to terms with us. If they insisted on working or combined to divide up all the time between themselves the Government stations could fall back on this and require them to give the Government communications half the time and relieve Government

stations of the necessity of "fighting for the air." There is no dignity in that.

It will be announced or stated that the Government communications are of small importance, as compared with the commercial business going through the stations. That is sometimes the case and sometimes it is not the case. In the case of communication with the Canal Zone—between here and the Canal Zone—and some of the communications of the New Orleans station, in view of the Mexican trouble, I would say that the Government messages are of many times more importance than the average urgent commercial message. Other cases reverse the situation, and the commercial messages are of more importance, and in those cases we fall back on the land wire for all except very necessary communications at sea with our own ships when we are not prepared to work overland with specially high-grade apparatus without interfering.

Section 25 has to do with sending out false radiograms and fixes a penalty.

Section 27 legalizes an arrangement that is now in force. Under the act passed in 1912, the Navy Department opened certain of their stations and with the ratification of the Berlin and London conventions the country was obligated to handle international accounts. That is, whenever a ship flying a foreign flag, a merchant ship, communicates with any shore station in the United States, the Government is required to look out for the accounting for that communication, and it looks to the Government owning the ship for the tolls collected from the sender of the message. In the same way, if a United States ship uses any foreign station, it immediately becomes the subject of accounts between the Government concerned and this Government. Somebody had to handle them, and as the Navy Department was the one handling commercial business, we have been looking out for these international accounts ever since. This gives the authority of Congress for that arrangement.

Section 28 provides the general penalties.

Section 29 provides for the enforcement by the Department of Commerce, with the paragraph permitting the Secretary to remit any fine, penalty, or other forfeiture, other than the penalty of imprisonment.

Mr. EDMONDS. Let me ask you a little something that occurs to me right here. The Secretary of Commerce seems to be carrying out this bill in all the penalty provisions and all matters of general supervision. Now, these wireless stations, if you take them over, would be under whose control?

Commander TODD. The Navy Department.

Mr. EDMONDS. Altogether?

Commander TODD. Yes, sir.

Mr. EDMONDS. Has the Army got any?

Commander TODD. Yes, sir.

Mr. EDMONDS. The Army has got some?

Commander TODD. Yes, sir; but the Army does not handle commercial work except in Alaska and at Corregidor near Manila, if I remember rightly.

Mr. EDMONDS. Does this turn the Army stations over to the Navy?

Commander TODD. No, sir; not at all. Only privately owned coastal stations.

Mr. EDMONDS. I know; but you are not in this bill arranging for any department to have charge, and it is going to be a mixed affair after you do take over these stations; the Secretary of Commerce has something to do with it, the Secretary of War has something to do with it, and the Secretary of the Navy has something to do with it.

Commander TODD. Yes, sir; but we are working now under a practical arrangement. The bill simply extends the activities of the Navy Department and to some extent the activities of the Department of Commerce. At the same time, the Department of Commerce would be relieved of the necessity of licensing the coastal stations taken over by the Navy Department.

Mr. EDMONDS. It does not say "shall" in this bill at all; it simply says the Government may take over or buy any stations the Government desires.

Commander TODD. In section 6 it says, "The Government, through the Navy Department, shall have authority to acquire by purchase." This has been agreed to by all departments.

Mr. EDMONDS. Yes; through the Department; that is right.

Commander TODD. That matter was adjusted many years ago, and all the departments have stuck to the arrangement then provided for and approved by the President, the gist of it being that radio telegraphy is of the greatest use to the Government of the United States through the Navy Department, on account of its strong need for control of the fleet and communications with it.

Mr. EDMONDS. When we open those to commercial business and can collect money for the different stations, it will be turned into the Government through the Navy Department?

Commander TODD. The Navy Department would collect the money and turn it into the Treasury, as we are doing now, sir. The bill increases the number of stations which will do the work we have been doing for four years.

Mr. EDMONDS. Is it the idea that the present stations belonging to the Army should be turned over to the Navy?

Commander TODD. No, sir. The Army stations, except in Alaska, are used for intercommunication in the artillery districts and for fire control purposes. They have not handled any commercial work except in Alaska and the Philippines, nor have they gone in for high-power stations. That has been our policy, which they have not adopted. Generally speaking they need only their stations in fortifications, their communications with mine-laying ships, and to some extent with their transports; between their stations on the Mexican border and field sets; and between two interior stations, one at Omaha and one at Fort Leavenworth. Except for coast defenses, work with portable sets in the field is of greatest importance to them.

Mr. EDMONDS. Let us assume you have a Secretary of Commerce who would not be friendly with the Secretary of the Navy, and the Secretary of Commerce commenced to hamper messages with commercial stations. Who would handle that?

Commander TODD. This bill does not give any power to hamper naval stations. The Department of Commerce could cause a large amount of correspondence and some confusion possibly; but fortunately there is no unfriendliness, nor is there ever any sign of that. We work in perfect harmony and cooperate very successfully. They carry out their bill. That is, the act now in force. There would not

be any new departure if this bill were passed. We keep them informed of our extensions and activities and handle their radiograms the same as we do those of the other departments of the Government.

Mr. EDMONDS. There will be a great many new questions arise when you are doing all the commercial business.

Commander TODD. No, sir; no more than now.

Mr. EDMONDS. And the Department of Commerce might not agree with the Navy Department in carrying out all of that business.

Commander TODD. The Department of Commerce agrees, and you will find that several of the departments indorse not only this bill but the extension of it—to complete Government ownership in the hands of the Navy Department. The Post Office Department maintains that there is no essential difference between radio communication and land-wire communication and that the Post Office should handle all kinds of communications.

Mr. EDMONDS. I agree with you that the present Secretary of the Post Office Department will agree to any Government-ownership proposition that would come under it.

Commander TODD. They concur in this, but believe that the Post Office Department should handle it.

Mr. EDMONDS. Oh, yes.

The CHAIRMAN. Every Postmaster General for years past, I think, beginning with Wanamaker and possibly further back than that, has recommended that the Government take over the telegraph system as a part of the postal system; and the present Postmaster General, following out the same analogy, also says the Government should take over the wireless, too.

Mr. EDMONDS. Don't you think it ought to print "Post Office Department" in here, too, somewhere, so that there would be three to work at it—so that two could have a majority at any time?

The CHAIRMAN. We take conditions as they arise and solve them. So far this bill is drawn along lines of the existing line of work, which are working with perfect harmony.

Mr. EDMONDS. I was rather curious, because it seems to leave the decisions to the Secretary of Commerce in the regulatory provisions, whether there would be any harmony when they got to work on this immense volume of commercial work.

Commander TODD. You will notice that the Secretary of Commerce alone regulates the commercial stations, privately owned concerns of all kinds, amateurs—everything except the Government stations. The Navy Department has no control whatever over privately owned stations, but would have all to do with the handling of the increased commercial work of its own stations. We do not expect a vast increase for some years.

Mr. EDMONDS. And the departments of the Government that actually own and operate apparatus operate the stations and ships in conformity with the London convention and their own regulations?

Mr. HARDY. Does not section 29 put the whole enforcement of this act in the Secretary of Commerce, notwithstanding other departments have a good deal to do with its enforcement?

Commander TODD. Notice the exception in the last three lines:

* * * except that provisions thereof relating to Government radio installations shall be enforced by the departments respectively controlling such installations.

That is the present arrangement; that is what we have been doing since we built the stations many years ago.

Mr. HARDY. Oh, yes; I did not observe that.

Commander TODD. Section 30 says how far the act shall extend and section 31 definitely repeals the act now in force.

May I say a few words more, sir?

The CHAIRMAN. It is now 1 o'clock. If you can conclude in 5 or 10 minutes, proceed; or, if you prefer, you may conclude to-morrow morning.

Commander TODD. I should prefer to sum up and state, in the strongest words I can find, the necessity for complete Government ownership to-morrow, if I may have the time.

(The committee thereupon adjourned to to-morrow, Friday, January 12, 1917, at 10 o'clock a. m.)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 12, 1917.

The committee met at 10 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

STATEMENT OF COMMANDER D. W. TODD, UNITED STATES NAVY—
Continued.

The CHAIRMAN. Commander, you may proceed.

Commander TODD. I won't take the time of the committee much longer. With what I said yesterday, and the questions of the committee, I have brought out most of the points. I will, with your permission, emphasize a few points that were brought out yesterday and will then speak briefly on the subject of neutrality and the main purpose of the bill.

I want to emphasize the point that, referring only to the section which opens Government stations to commercial business, what we are doing is taking from the commercial companies in time, through efficiency of operation, the shore end of the commercial business only. The ability of ships to communicate with shore is facilitated rather than interfered with, and our management of it would tend to smoothness of working and the elimination of interference, which is steadily growing, something I will touch on a little later. It does not mean that the Navy would ask for additional money with which to put up stations to handle this business. The stations are there and have been for some years, some of them ever since 1906, and they are handling Government business only. They are fully manned, ready. It would not be a new business for us, because we are handling considerable commercial business now. There are 51 stations altogether, 23 of which are handling commercial business. Of those not handling commercial business, some of them—notably Arlington and Darien—will remain as they are, because they are reserved for Government purposes only. They are so useful to the Government for its own messages that they could not be spared for commercial business and so be of more use to commerce than they now are. There are a sufficient number of others that have been

guarding our coasts these many years. It is simply an extension of our present activities, for which we are ready with a very slightly increased office force. Maybe we will have to ask for a clerk or two. We will go ahead and take up this additional commercial work, but we do not expect for some years to have more than double the amount of work we are now doing, and we can easily handle it; we have the organization and are ready.

This bill, I believe, will be opposed. I do not fear that it will be opposed; I believe it will, because past history indicates it. Every radio bill that has been brought before this committee of Congress has been opposed. The ratification of the Berlin convention was strongly opposed. I can not answer for the London convention, as I was not here. The opposition will be able to show the committee, without any doubt about it, that they do not wish to sell their stations or give up their business; they do not wish the Government to extend its activities. They bitterly opposed the feature of the last bill by which Congress allowed us to take up this commercial business in out-of-the-way places and at frontier stations.

They will show the committee, and prove it, too, even by the Government's own experts, by their writings and possibly by their testimony before this committee, that this question of interference—there is nothing to it; it can be avoided by such and such measures and such and such apparatus which they have or expect to have soon, but they will only begot the issue by talking of decrements and wave lengths and selectivity. In this case we are after everyday practical working conditions, and we have some one who will be able to inform the committee at first hand, to give the committee first-hand information on that subject, an expert of the highest order. He does not get his information from written reports from electricians in charge of stations, who are anxious to show how efficient their stations are; or through log books of ships to show what the operators regard as interference; or from general reports; but from his own personal observation on many parts of this coast. His testimony on the matter of interference is of such importance to us that I will say no more on the subject.

The CHAIRMAN. To whom do you refer?

Commander TODD. Lieut. Commander Hooper, sir.

Mr. GREENE. Is he coming before the committee?

Commander TODD. I have him here now, sir.

I would now like to mention the subject of neutrality. There has been a great deal in the newspapers about the difficulty of maintaining the neutrality of the United States when radio stations can and do send out messages which are of military value to one or the other of the belligerents. The movements of a merchant ship are of very great importance to the warships of the enemy. If messages are picked up, as all those messages can be picked up, showing that a certain merchant ship has sailed or expects to sail from a certain port, even that information is of value although her destination be not definitely known; because that can easily be guessed at from the nature of the ship and the port from which she sails. But that is only a very small example of the unneutral service that may be performed. Of high-power stations, Sayville and Tuckerton, we can not say much in open session. We have had to make the very strictest rules for those stations; special rules, so that there would be no

possibility of the British Government or the French Government complaining of the unneutrality of those stations. To avoid any possibility of unneutral service we have required everything except German embassy messages to be in plain language. But even that requirement does not fully eliminate the possibility of unneutral service. To go back a little, the President assigned to the Navy the duty of maintaining neutrality so far as the work of radio stations was concerned.

It has been enforced with the greatest difficulty and in spite of the cooperation of the commercial companies. The commercial companies owning shore stations have earnestly tried to assist us in every way, but the inherent difficulties are such that to make it effective we have had to make general regulations governing all stations. That works a hardship in some cases. The department is bound to do everything possible to make it effective by consistent regulations.

We all know how many suggestions there have been of our getting into this war. There have been several cases where we have had information sent out by radio that might lead us into trouble. When the submarine raider, the *U-53*, suddenly appeared on our coast and commenced sinking ships several communications went out indicating that such and such a ship had been sunk at such and such a place and by a German submarine. There was one case in particular, and lately I have heard of several others. Those messages might have two effects. One would be to warn merchant ships of the allies to get into port as soon as possible or to change their destination and make a break for the 3-mile limit to avoid this submarine. The other effect would be to inform British cruisers that have been hovering near our coasts from time to time since the war started that this submarine was in this part of the ocean and in a very well-defined area off Nantucket Shoals. In both cases we are aiding the allies in letting such messages get out. The question of distress calls came up. If an American ship or one of our stations picks up a distress call and broadcasts it, which is the usual procedure in case of distress, the broadcasting of messages saying that a German submarine has sunk such and such a vessel in a certain longitude and latitude might have the effect I have mentioned of warning vessels to seek neutral waters and bringing the allied warships to the spot; or, if they report such and such a vessel sinking in such and such a latitude and longitude and say nothing about a German submarine, it might cause other allied vessels to come to the aid of passengers and crew of the sinking vessel.

Mr. GREENE. Is there anything wrong in that?

Commander TODD. The German submarine might be in the neighborhood and other ships might be sunk.

Mr. EDMONDS. Assuming the Government had been running the wireless at that time, would not the Government have done exactly the same thing?

Commander TODD. No, sir; all such Government messages are presumably sent in code, and the instructions cover that.

Mr. EDMONDS. But would not the Government have given the newspapers the information that such sinking occurred and thereby have given the Germans notice?

Commander TODD. Yes, sir; to the newspapers, but that is not sending it out over the ocean, sending it broadcast.

Mr. GREENE. Do you object when a vessel has already been sunk or is probably sinking, to any provision being made to take care of the people aboard the vessel?

Commander TODD. There is provision made. Coast guard vessels and the nearest naval vessels take such action as may be ordered, but we say nothing about it broadcast by radio.

Mr. EDMONDS. Do you mean to tell me you would allow other ships, by sending out a rescue call, to go into that radius and be sunk, too?

Commander TODD. If the sinking ship sends out a distress call we can not repeat it without the possibility of assisting one belligerent or another. We may not warn other ships.

Mr. EDMONDS. Also the Government might go to work, by notifying the ships of other nations when sailing from ports, by wireless, and thereby give the Germans notice these ships were coming out of port, thus affording them a chance to get at them, too.

Commander TODD. That is what I am trying to bring out—that the whole question is so complicated that it deserves the serious attention of the committee. That is along the lines of a statement I made, that we have kept our radio neutrality with more or less success, with the greatest difficulty, in spite of the cooperation of privately owned radio stations. Stations under direct Government control are necessary.

Mr. EDMONDS. The two radio stations, at Tuckerton and Sayville, I understand they exchanged messages by cipher which were taken for commercial business concerns; had you been running them as Government stations at that time, you could not have refused a commercial message from a reliable concern in code, and doing the same work exactly that was being done by those two stations when you took possession; and would not the sending of such messages be considered far more unneutral if the Government were running those stations than if a private concern?

Commander TODD. Unless the Government would not transmit any message which could be picked up by an enemy and be of value to them.

Mr. EDMONDS. How could you tell?

Commander TODD. It would be in code and we would require a translation.

Mr. EDMONDS. Suppose they had a cipher to the code; we don't know.

Commander TODD. No, sir.

Mr. EDMONDS. You could not?

Commander TODD. We could not tell.

Mr. EDMONDS. Let us assume that had there been a Government station there, and I had come there with a code message or a cipher message to be sent out; you would have to send it?

Commander TODD. We would have done one of two things, depending on what our instructions were; we would have shown you our instructions saying that no cipher or code message would be allowed to be transmitted to a German station; or that we could send the message provided you gave us a translation of it and satisfied us that it was a bona fide translation. In any event, no information of value to belligerent military or naval operations would be sent.

Mr. EDMONDS. Are you doing that now in your commercial stations?

Commander TODD. We are requiring plain language in radiograms addressed to belligerent stations or ships, and forbidding the sending of the information mentioned above.

Mr. EDMONDS. In all your commercial stations?

Commander TODD. In all radio stations of the United States. I have here a copy of our neutrality regulations which I wish to have made part of the record.

INSTRUCTIONS RELATING TO ENFORCEMENT OF PRESIDENT'S EXECUTIVE ORDER
REGARDING RADIO COMMUNICATION.

[Modified Apr. 21, 1915, and Mar. 8, 1916.]

NAVY DEPARTMENT,
Washington, January 1, 1915.

The following instructions supersede all previous instructions and will be in effect from the date of their receipt:

1. Radio messages containing information relating to the location or movements of armed forces of any belligerent nation, or relating to material or personnel of any belligerent nation, will be considered as unneutral in character and will not be handled by radio stations under the jurisdiction of the United States, except in the case of cipher messages to or from United States officials.

2. No cipher or code messages are permitted to be transmitted to radio ship stations of belligerent nations by any radio shore station situated in the United States or its possessions or in territory under the jurisdiction of the United States. Similar messages received by such radio stations from ships of belligerent nations will not be forwarded or delivered to addresses.

3. No communication of any character will be permitted between any shore station under the jurisdiction of the United States and warships of belligerent nations, except calls of distress, messages which relate to the weather, dangers of navigation or similar hydrographic messages relating to safety at sea.

4. No cipher or code radio message will be permitted to be sent from or received at any radio station in the United States via any foreign radio station of a belligerent nation, except from or at certain stations directly authorized by the Government to handle such messages. Press items in plain language relating to the war, with the authority cited in each item, will be permitted between such stations, provided no reference is made to movements or location of war or other vessels of belligerents. The restriction as to the movements or location of war or other vessels of belligerents shall not apply to press items received from belligerent shore radio stations.

5. No radiogram will be permitted to be transmitted from any shore radio station situated in the United States or under its jurisdiction to any ship of a belligerent nation or any shore radio station that in any manner indicates the position or probable movements of ships of any belligerent nation.

6. Code or cipher messages are permitted between shore radio stations entirely under the jurisdiction of the United States and between United States shore stations and United States or neutral merchant vessels or neutral shore stations, provided they are not destined to a belligerent subject and contain no information of any unneutral character, such as the location or movements of ships of any belligerent nations. In such messages no code or cipher addresses will be allowed except those registered prior to July 1, 1914, and certified copies of which are filed at the United States radio station through which the message is to be transmitted. All messages must be signed either with the sender's name or with a duly certified registered name complying with the requirements for registration of address. Radio operating companies handling such messages must assure the Government censor as to the neutral character of such messages. Such messages, both transmitted and received, must be submitted to the censor at such time as he may designate, which will be such that will not delay their transmission.

7. In general censoring officials will assure themselves beyond doubt that no message of any unneutral character is allowed to be handled.

8. In order to insure that censors may, in all cases, be informed thoroughly and correctly as to the contents of radio messages coming under their censor-

ship, they will demand, when necessary, that such messages be presented for their ruling in a language that is understandable to them.

9. At such radio stations where the censor is not actually present at the station when messages are received by the radio station for forwarding either by radio or other means, messages may pass provided they are unmistakably of a neutral character, without being first referred to the censor, but the operating company will be held responsible for the compliance by their operators with these instructions.

Approved :

JOSEPHUS DANIELS,
Secretary of the Navy.

Mr. EDMONDS. When did you start; after you found out it was being done in those private stations? You did not start when the war started, but the instructions were issued when you found out that such a thing was possible in those private stations?

Commander TODD. I won't say that. I am not familiar with the early instructions, but I doubt it. The neutral regulations were gotten up by the State, War, and Navy Departments, jointly, I understand; how early in the war I can not say, because I was not here. I can obtain the information, however.

Mr. EDMONDS. It is your opinion that neutrality would be better preserved if the Government owned those plants?

Commander TODD. It is the only effective way of preserving effective neutrality.

Mr. EDMONDS. Would that be a better way to prevent a breach of neutrality than if a private concern owned the plants?

Commander TODD. I believe it would absolutely prevent a breach.

Mr. EDMONDS. You do not think it would precipitate a more serious question than if they were in private ownership?

Commander TODD. It could not precipitate a more serious question. We are in duty bound to prevent anything which is not covered by existing international law going on on our shores that assists one side or the other. As I said, this question of the Sayville and Tuckerton stations has been so much in the public press, and there has been so many claims that unneutral messages had been sent, that we have had to make the regulations very strict, and when the Marconi Co. wished to take up commercial business with Japan we found ourselves in the position of imposing on them the same conditions that applied to Sayville and Tuckerton, although the Pacific Ocean is clear of belligerent operations, and there is cable communication with Japan. We had, for consistency, to treat one nation the same as the other. Japan being one of the allied nations, messages destined for that country were treated and are treated exactly the same as those for Germany, with a slight modification in regard to code addresses in use prior to beginning of the war, at the earnest request of the Marconi Co. There are many things to-day which could be done on the Pacific Ocean on account of there being no German ships on that ocean at present, and the elimination of German interests as far as the Caroline Islands; but for consistency's sake those burdensome regulations—they must be more or less burdensome—on commercial business are enforced in that part of the world.

Mr. GREENE. Are you censoring the cable messages?

Commander TODD. No, sir; we have nothing to do with them. They are perfectly free. They are censored at the other end, and we do not censor them here. Recently Sayville and Tuckerton——

Mr. GREENE. I do not see why that would not be as dangerous as the wireless message.

Commander TODD. It is not so dangerous in this way, sir; the information passes under the sea and no one gets it because no one can pick it up between this end of the cable and the censor at the other end—there is a British censor at the other end of the cable—but a radio message can be picked up by any vessel at sea—any war vessel, any merchant vessel, or anybody who has a proper receiver. It is open to all. It is like my making openly here any one statement, which every person in the room gets if he chooses to listen. That is where the difference comes in; that is why it is necessary to censor radio stations. We do not censor receiving. The reception of messages and their transmission through the country by newspapers, telegraph, etc., is unrestricted; but the sending broadcast to ships at sea information that is of value to warlike operations is unneutral service, has always been so considered, and we have put forth our best efforts to guard our neutrality as well in this matter as in any and all other matters, with difficulties just as serious as you have seen in other cases.

Mr. EDMONDS. Do you censor all of the high-power plants now?

Commander TODD. Yes, sir; we have censors for all of the high-power plants that communicate with the nations at war. We do not censor any communications to another neutral country or with our own ships—ships of the United States. Communications with the nations at war are the ones which are censored. There is an officer detailed for that purpose at every such station, and he passes upon every message. If the officer has the slightest doubt, he telegraphs the message to the Navy Department for instructions.

Mr. EDMONDS. You have men, then, located at every high-power plant?

Commander TODD. Yes; those that communicate with any of the countries at war, which means only the Sayville and Tuckerton Stations and the Kahuku Station of the Marconi Co. on the island of Oahu.

There is more to be said upon the question of neutrality, as I said before, but I can not tell the whole story here. I hope that I have said enough to indicate that the strictest of Government control is necessary in these very sensitive times when we may be drawn into this European war. The only way to guard our neutrality properly is by permitting only those stations to operate which have officers and operators used to the strictest military control.

Just a few words, sir, and I will close. The opposition to the bill will bring up many points. They are going——

The CHAIRMAN. You understand the proponents of the bill will have the opportunity to close the hearing.

Commander TODD. Yes, sir.

The CHAIRMAN. And to answer any objections that may be made. That would be the logical order, I should think.

Commander TODD. I would like to say that there will be many points brought up, and the Naval Radio Service—they will probably point out some faults in it, and maybe some uncorrected faults.

I wish the committee would keep in mind the military necessity for this matter. Before the bill was born, months ago, it was opposed in a printed document. It accused the Government executive departments of furthering such a bill under the guise of preparedness. I want the committee to know this is not a guise at all; this is a real necessity. We read in the newspapers every day of such and such a delicate subject being handled. The papers are full of what the President is going to do next, and how every word is treated abroad; and so many people in this country have taken sides in this war, in one way or the other, that constantly in the newspapers comes out the hint that we may be drawn into this world-wide war, as they call it. Just the other day there was a little squib in the paper which quoted Secretary Lansing, if I recall it correctly, as saying that the United States has made this move toward peace for fear the United States, if the war should continue much longer, would be drawn into it. All those things point to preparedness, and this is a real question of preparedness. These stations operated by commercial companies and taken over by the Government after a war starts—that means nothing. The war having actually begun, the stations would be closed and a seal put on the doors, so they could not do any sending, and that would be all there would be to it. It would be too late. The mischief would have been done before the war commenced—in those few precious hours immediately preceding the outbreak of hostilities. We have seen with what suddenness modern wars have started. The Japanese attacked the Russians overnight; no warning at all. The astounding suddenness of the outbreak of the present tremendous conflict was a startling thing to the world; events followed one another so fast. We can not afford to have any thought of preparedness along these lines that does not mean instant readiness, and we can not be ready for instant control of this fleet, nor can we be instantly ready to prevent our stations giving out information of value to the enemy unless we are in control at the first blush of hostilities.

I feel more strongly on this subject than I can express. There are others who will speak much more strongly and I am going to stop my part of it here.

The CHAIRMAN. As I understand your view, we are spending hundreds of millions, even billions of dollars, for national defense and especially to build up and strengthen our Navy, and one of the essential elements to make that defense effective is control of these stations?

Commander TODD. Yes, sir. What we would have to do in time of war—

The CHAIRMAN. And yet it is of course natural that private interests always kick when the Government comes in contact with them and the public interest is not in harmony with their interest. Just like other people, they are selfish; they think the public interest should be subordinated to their interest and we should not interfere with their commercial transactions; but I think they are patriotic, and, in the event of war, would behave nicely.

Commander TODD. I hope it will be plain to the committee that the national interests are paramount and, in this case, private commercial interests should be protected as far as possible by buying

them out at this time when it can be done with comparative ease. I mean with a comparatively small expenditure of public funds. This measure is advocated by all of the departments of the Government, and in some cases in such strong language that I wish the committee would have these indorsements by the executive departments read. The question is presented in such clear language in the two or three I have been allowed to see that appending them to this hearing in a printed document I am afraid will not suffice; I am afraid the members of the committee, having many important matters to handle, will not find time to go into those printed pages, especially as these appendices are written in a smaller type than the rest. I refer particularly to the letters of the Secretaries of the Departments of Commerce, Labor, Treasury, and Navy.

The CHAIRMAN. At the proper time of course, I will cause all the communications of the departments to be read, when we can have the full committee meeting.

Commander TODD. Yes, sir.

The CHAIRMAN. It won't take long and it will give the committee the viewpoint of the departments.

Commander TODD. One thing more on the matter of military necessity. The little island of Oahu, the principal island of the Hawaiian group, with the city of Honolulu on it, also the naval station at Pearl Harbor, has three high-power stations; and so important is that little island of the Hawaiian group to the Government, in the eyes of the Navy, that I can not get anybody in the Navy Department to listen to me with patience on the subject—the situation appears to us impossible, dangerous, and requiring immediate action, however strong.

I thank you, sir.

STATEMENT OF HON. THOMAS EWING, UNITED STATES COMMISSONER OF PATENTS.

Mr. EWING. Mr. Chairman and gentlemen, I was appointed by Mr. Secretary Lane to represent the Interior Department on the commission, and I have attended the various sessions and hearings, and wish to say that the Secretary is strongly in favor of this bill, as I am, and has strongly expressed himself in writing to the committee. But I know that his statement did not go beyond this bill; it did not give his acquiescence in the proposal of complete Government ownership. Personally, I am not in favor of that. The department, however, has little or nothing to do with the question, and therefore I shall not give my reasons for not favoring Government ownership unless the committee requests me so to do. I therefore, for the moment, appear merely to say, at Commander Todd's request, that I, together as I understand with all the members of the committee, am in entire accordance with the principles of this bill.

The CHAIRMAN. Are you in favor of the bill as it is written and proposed here?

Mr. EWING. Yes; the bill as it is here presented.

Mr. EDMONDS. Section 6, Mr. Commissioner, gives the Government the privilege of taking over all plants at their option.

Mr. EWING. I think that says all shore stations, does it not?

Commander TODD. Coastal stations.

Mr. EWING. Yes. Now, I will explain my position. That is exactly as I understand it. The profitable end, so far as we could ascertain from our investigation of the radio business commercially, lies in the sale of apparatus to ships, or the leasing of apparatus to ships, and in the transmission of messages from high power stations. As an adjunct to the sale of apparatus to ships, it is essential that shore stations be maintained, but the number of messages received by any one shore station or transmitted by any one shore station, so far as we could ascertain, is not sufficiently large to make that business profitable. Now, it seems to me entirely reasonable that the Government should absorb all of those shore stations; where they are really needed for commercial purposes, let them be used for commercial purposes; take over, in other words, the business of receiving messages that are sent from ships at sea and that in no way, so far as I can see, interferes with the sale by private concerns of their apparatus for use on the ships at sea. On the contrary, I believe (although I do not claim to speak as an authority on that subject at all, but from our investigation and hearings we had) it would relieve the manufacturing concerns of what is a burden upon their commercial business. Those stations, the shore stations, will be multiplied and the Government, therefore, should maintain control to avoid difficulty and should buy them now if it is ever going to buy. The big power stations will not be numerous and they can be controlled under regulations which could be instantly put in force, it seems to me, in emergencies. Of course I speak with entire deference to the Navy Department on this.

Therefore this bill, as I say, the main purpose of it, is to take over the shore-station business and to give the Government the right to limit, by license, all wireless business, which I think is absolutely right and essential. Beyond that, personally I do not believe in going, for reasons which may not interest the committee.

The CHAIRMAN. Even from the viewpoint of the manufacturers of apparatus, if the Government supplies the necessary number of shore stations, they would have the same opportunity to sell.

Mr. EWING. To sell to ships.

The CHAIRMAN. No; they would have to furnish apparatus for the shore stations, would they not?

Mr. EWING. Oh, yes.

The CHAIRMAN. Whether they belonged to private parties or to the Government.

Mr. EWING. They probably would; yes.

The CHAIRMAN. But, in the process of time, under private control, the shore stations might be unnecessarily increased.

Mr. EWING. Yes.

The CHAIRMAN. Which would mean a waste of capital and, of course, the disposition is to charge that back on the public; in other words, to make up any possible loss of that sort. So, from a commercial standpoint, whether controlled by the Government or not, there would be only so many shore stations needed.

Mr. EWING. Yes.

The CHAIRMAN. And if the Government undertakes to supply those shore stations, the manufacturers of apparatus must supply those stations, and they would simply supply the need that the commercial stations in a haphazard way undertake to supply now.

Mr. EWING. By shore stations, if you mean what I mean, coastal stations—

The CHAIRMAN. Yes.

Mr. EWING. For communication with ships—we agree entirely on that. What I was talking about was these high-power plants on land, which are not intended for ship-to-shore communication primarily.

The CHAIRMAN. Yes; perhaps I did not get your meaning.

Mr. EWING. It is those, in addition, which the Navy Department proposes taking over, those are the ones I mean.

The CHAIRMAN. Those are high-power stations?

Mr. EWING. Yes.

The CHAIRMAN. You make, then, a distinction between coastal stations?

Mr. EWING. Yes.

The CHAIRMAN. Like the Tuckerton and Sayville.

Mr. EWING. I would not take those over.

The CHAIRMAN. And the one on the Hawaiian Island?

Mr. EWING. No.

The CHAIRMAN. You do not see any good reason why the Government should take over the control of those high-power stations on the Island of Oahu?

Mr. EWING. I have no knowledge of the situation on the Island of Oahu; but I may say, it seems to me if there is a situation there of very great and delicate importance, it can be dealt with as an exceptional case.

The CHAIRMAN. That may be an exceptional case.

Mr. EWING. But my objection is to the Government taking over the wireless business of the whole United States, in all its aspects, excepting the sale of apparatus to ships. That, I believe, would be a mistake. But, as I say, my department is not interested in that and therefore I will not express my reasons unless the committee asks them. But I wish to emphasize the fact that as this bill is drawn, I am entirely in accordance with the purpose and believe in it; so does my department. That is why Commander Todd asked me to appear at this hearing.

Mr. EDMONDS. Mr. Commissioner, when you buy a patented article, or when the Government buys a patented article, suppose the Government wants to go into the manufacture of that article, could it do it without paying any royalty to the patentee?

Mr. EWING. No. That is to say, the patentee could sue the Government in the Court of Claims.

Mr. EDMONDS. And these patentees are now doing that, aren't they?

Mr. EWING. Yes.

Mr. EDMONDS. For infringement of the patents?

Mr. EWING. Yes.

Mr. EDMONDS. And they have the same right against the Government as they would have against an individual.

Mr. EWING. They have the same right of recovery.

Mr. EDMONDS. They have the same right of recovery?

Mr. EWING. But not the right of injunction; they can not stop the Government from doing it.

Mr. EDMONDS. There is no provision of the patent laws that permits the Government to manufacture these machines for their own use without paying any royalty?

Mr. EWING. No; there is not.

Mr. EDMONDS. I was under a mistaken impression about that and wanted to get it clear in my mind. I thought the Government could utilize any patent.

Mr. EWING. The Government can utilize any patent, but it is subject to suit in the Court of Claims for damages. It can not be stopped from doing it, as can a private party.

Mr. SAUNDERS. What, exactly, is meant by "a coastal radio station"; a station necessarily on the very brink of the ocean?

Mr. EWING. It is a station the purpose of which is to communicate with ships at sea in the general neighborhood.

Mr. SAUNDERS. What I am trying to get at is this: Take this station across the river here, can that fairly be called a "coastal station"?

Mr. EWING. It is on the coast, but not a coastal station. It is a high-power station. The radio station at Arlington is one of the great high-power stations.

Mr. SAUNDERS. A coastal station, then, properly, is one immediately along the ocean's brink?

Mr. EWING. It is one intended to pick up messages from ships approaching the shore and to give messages to ships leaving the shore.

Mr. SAUNDERS. The meaning, then, of "coastal station" is rather to be derived from the business it does than its particular location?

Mr. EWING. I think so; except, as a matter of fact, they are located at seaports.

Mr. EDMONDS. If that station at Arlington was in the hands of private parties to-day it would be one of the stations contemplated to be taken over under this bill, undoubtedly?

Mr. EWING. I think not.

Commander TODD. No; not under this bill unless it were licensed to communicate with ships. It could communicate with ships, but would probably not be engaged in that especially; it would be engaged in long distance transmission between distant points.

Mr. SAUNDERS. This section 6—I am not familiar with the entire bill, but section 6 does not seem to contemplate the condemnation of those plants but only their purchase in case the owners desire to sell.

Mr. EWING. The section is based on the theory that as a matter of fact, whatever they may say, the business does not pay them and they will sell.

Mr. SAUNDERS. I see.

Mr. EWING. But if they want to hold on, there is nothing in this section to force them out.

Mr. SAUNDERS. That is what I understood section 6 to mean.

Mr. EWING. Of course, you can understand, these men in the wireless business, if they have something to sell under section 6, are not going to tell us before hand they have something that has no value. You can not blame them for that.

Mr. SAUNDERS. There is nothing else in the bill which compels the compulsory taking over of plants, is there?

Mr. EWING. No; the theory of the bill is only to control by license, not by taking them over.

Mr. SAUNDERS. It contemplates their acquisition——

Mr. EWING. It contemplates their acquisition purely by purchase.

Mr. SAUNDERS. A voluntary sale on the part of the owner.

Mr. EWING. That is it.

Mr. SAUNDERS. Now, with respect to this question of the unnecessary increase of stations and the multiplication of plants, is not that a matter, looking at it from the economic side, that would be controlled like any other competitive business? I take it the people who go into this as a commercial enterprise have in mind profits, just as a man who goes into the telephone business, the railroad business, or any other business designed to supply public wants.

Mr. EWING. Yes; but meanwhile great damage may be done because of the confusion to our commerce or in some emergency.

Mr. SAUNDERS. In what way?

Mr. EWING. By messages not going through, interference with messages in reaching their destination.

Mr. SAUNDERS. You mean if we undertake to increase the number of these stations that it increases the difficulty of using the air as a vehicle of transmission.

Mr. EWING. Of getting a message to a particular person at a particular spot, yes; interference in other words——

Mr. SAUNDERS. In other words there can not be any universal use of the air for commercial purposes; but, of necessity, in the nature of things, it has to be a limited use?

Mr. EWING. It has to be a use where one man is not interfering with another at the same moment.

Mr. SAUNDERS. And it is thought to be necessary for the Government to ascertain, so far as they can, what number of stations may use the air without interference with one another?

Mr. EWING. Yes; and that is largely the purpose, one of the great purposes, of the London convention to which other nations have agreed. Just by way of illustration of the uses that may be made, there is a concern that has a big store in Philadelphia and another store in New York, and it sends out messages ordering socks and things sent from one place to the other, meanwhile interfering with the shipping communications by wireless which can not be made in any other way. Now, such a use seems to be ridiculous.

Mr. SAUNDERS. The effect of that, then, seems to be that in the ordinary relations of commercial business life of the United States the wireless can not be developed for such purposes on account of the fact it will be filling the air with such a volume of sound that it will interfere with other and conceivably more important business?

Mr. EWING. The effect is that the Government can not for its own purposes—that is, for its naval purposes and for the protection of commerce—make the most efficient use of wireless that is now possible.

Mr. SAUNDERS. On the commercial side?

Mr. EWING. Yes.

Mr. SAUNDERS. For instance, what I had in mind was this: Suppose in the development of the machinery that is being used in the connection with wireless transmission, it becomes altogether feasible, in a commercial way, to use the wireless for communication between

this point and Richmond, this point and New York, Chicago, etc., for ordinary everyday business, yet it might not be wise to allow that to be done because it would be interfering with other transmission of greater importance than the ordinary commercial business?

Mr. EWING. Yes. For example, here is a ship at sea; there is absolutely no way of reaching that ship except by wireless. There are plenty of ways for reaching Chicago from here and San Francisco from here besides wireless. Now, if the use of wireless between here and Chicago interferes with the communication between here and the ships at sea, the theory of this bill is that the Government ought not to permit it and ought to regulate it as far as necessary.

Mr. SAUNDERS. Under that view, then, the possibilities of this wireless field, instead of being unlimited, are really very limited ones?

Mr. EWING. The present difficulties are very great. Now, it may be that with the advance of the wireless art, the problem of communication will be so completely solved that one does not interfere with another; but that has not been accomplished.

Mr. SAUNDERS. That was the next question I was going to ask.

Mr. EWING. That has not been accomplished by any means.

Mr. SAUNDERS. I was going to ask, having in mind what has been accomplished by human ingenuity in other fields, whether if this is left free for development and improvement by the ingenious minds working on it that difficulty would not be removed, whereas if we just sit down in advance and say we are going to cut off the possibilities of commercial development because they interfere with what I assume for the time being are more important uses and shut them off in advance, you limit the possibility of development along that line for these great commercial uses.

Mr. EWING. That is true. And the question, I think, that the Congress has to take into account is where it is going to draw the line. We have a present situation and we have the future possibilities. The present situation is that we have an instrumentality for communication that is of great importance to the Government and to commerce, and we ought to get the benefit of them. The future possibility is it may be made very much better. My theory and my objection to the theory of Government ownership is that if the Government takes over the wireless business it will largely be the end of the development of wireless.

Mr. GREENE. That is just what I was going to suggest myself.

Mr. SAUNDERS. That is the very thought I am developing and what my preliminary questions lead up to.

Mr. EWING. Therefore I say I am in favor of strict regulation in this act, and, in my judgment, it does not go too far to meet the present situation. But I am opposed personally—I do not speak for the department, because the department is not interested, but I happen to be the Commissioner of Patents and am interested in that way—to the idea of shutting out or seriously limiting, or limiting any more than is necessary, the field of operation of private enterprise in the development of wireless.

Mr. SAUNDERS. That is just what you no doubt noticed my questions were developing—that thought?

Mr. EWING. Yes.

The CHAIRMAN. Is there anything in this bill that would do that?

Mr. EWING. There is not anything in this bill that would do that. In my opinion that would be a serious handicap.

The CHAIRMAN. Has any apparatus been invented thus far which will control interference?

Mr. EWING. There is apparatus about which claims have been made; I do not believe apparatus which actually accomplishes it, certainly none which accomplishes it in the broad sense. What may be possible nobody can say, but there is unquestionably hope of great advancement. The difficulty about it is that the general methods of communication which make it possible to use one wire to send a number of different messages depend on differences of degree. One current of a certain character will come through strong; another current of a certain character to that same station will come through weak. The strong current will operate the apparatus, and the weak one will not. But where you have the problem of wireless to deal with you have energy dissipated according to the square of the distance. With two stations within a mile of each other and one communicating a thousand miles away, the law of the square of the distance means a million times as great diminution of the strength of the current in the one case as in the other, and therefore you can not rely on initial differences of lengths of current at the sending stations to produce those differential results. I do not mean that is the only way of attacking the problem, but that is one of the ways that was tried and proved a failure.

Mr. SAUNDERS. Just in that connection I want to ask this: The question of the extent to which your message will go depends on the initial power, I suppose.

Mr. EWING. Yes.

Mr. SAUNDERS. What we call the high-power stations?

Mr. EWING. Yes.

Mr. SAUNDERS. Those stations which have, as contrasted with the general run of stations, very exceptional power?

Mr. EWING. Yes.

Mr. SAUNDERS. This station at Arlington is one of them?

Mr. EWING. The station at Arlington is one of them; yes.

Mr. SAUNDERS. Take messages sent out by such a station as that and having, for instance, a little station like the one down here on the Butler Building, I believe—I believe there is a station there?

Mr. EWING. Yes.

Mr. SAUNDERS. Suppose the Arlington station sent out a message designed to reach Panama or, possibly, Hawaii, at the same time this little station was sending out a message designed to reach Baltimore, would the transmission of the message to Baltimore interfere with the Arlington transmission?

Mr. EWING. Oh, no. But, supposing one message from Arlington was going to Hawaii, and, after traveling, say, a distance of something like 5,000 miles, you found there, in sight of the Hawaiian receiving station, a little transmitting station transmitting to one of the little islands of the group, its waves would react right there, and that would prevent the receiving of the message.

Mr. SAUNDERS. Transmission at the receiving end would bar its receipt?

Mr. EWING. Transmission at the receiving end would prevent its receipt.

Mr. SAUNDERS. But not so with competitive transmission at the transmitting end?

Mr. EWING. Not of this little one here; no.

Mr. SAUNDERS. Out at sea, then, the trouble that arises, if I follow what you just stated, is not so much these little stations as it is the other ships; it is the messages that are being sent out by the ships? Pretty much all the commercial ships of any size are equipped with wireless now?

Mr. EWING. I do not think they send so many messages from the commercial ships themselves.

Commander TODD. They send them, but it is more scattered and not so congested as it is in the large ports.

Mr. ROWE. But the sending to ships in the port would be interfered with?

Mr. EWING. Yes.

Mr. SAUNDERS. These ships are interfered with by what?

Mr. EWING. They are interfered with by their own messages and, possibly, other commercial stations.

Mr. SAUNDERS. You say the ships do not send many messages? I have been out on a good many ships, and they seemed to me to be about as busy sending as receiving.

Mr. EWING. That statement is perhaps extreme. The real statement is the ships have got in some way to take care of themselves. The apparatus is there to be used, and they have to take care of themselves, because if they do not they will, of course, put themselves all out of business. But we ought not to be building upon the shore stations that are unnecessary to the business.

Mr. SAUNDERS. Which would interfere with them?

Mr. EWING. Yes.

Mr. SAUNDERS. I agree to that; but what I was trying to get at was whether the problem, so far as ships are concerned, is not one which arises out of competition and the trouble they make with each other rather than the little commercial wireless developments on land, particularly little interior stations.

Mr. EWING. That would depend. Take, for example, the port of New York. There, of course, the difficulty of wireless transmission is already very great because of the great number of ships coming in. Now, to have a little station in New York City transmitting a perfectly unnecessary message to Philadelphia—I mean a message that could be sent in some other way perfectly well—it seems to me is absurd.

Mr. SAUNDERS. That would interfere, then, with the receiving of messages on those ships?

Mr. EWING. In the neighborhood of New York; yes. And that sort of thing is likely to develop unless we could control that.

Mr. HARDY. It would interfere with receiving messages from the ships that were reaching their destination.

Mr. EWING. Yes; interfere more that way than the other way.

The CHAIRMAN. The ship with the high-power apparatus would smother out the ship with the weak apparatus, depending on the distance out?

Mr. EWING. Yes; but the ships being fairly scattered, and their apparatus, I suppose, fairly standardized, I do believe the commercial companies can handle those aspects of the commercial busi-

ness; that their interests will lead them to do that, and that the thing will develop satisfactorily, so as to get the largest use of the apparatus. But what we ought to do is to maintain the very best conditions for that activity.

Mr. SAUNDERS. Then, Mr. Commissioner, having that in mind, I would like to ask this question. Low-power wireless stations in the interior, for instance, St. Louis doing business with Chicago—those stations would not in any wise interfere with ocean receiving, would they?

Mr. EWING. I do not believe so. I believe that could be met perfectly satisfactorily and could be operated perfectly satisfactorily, so far as I know the art. I am not an expert on wireless; I am only answering the best I can.

Mr. SAUNDERS. Then this problem of working out devices to get away from this difficulty of interruption is one that is being worked on continually now, is it not?

Mr. EWING. Yes.

Mr. SAUNDERS. I see a great deal about it in the press.

Mr. EWING. Yes; and large claims are made for apparatus; but I think the success so far has not been large.

Mr. SAUNDERS. But, of course, if that can be developed, the machinery and devices for the purposes can be developed, the difficulty suggested in the way of interruption would pass; that would be dissipated, and the necessity for this taking over would be minimized to that extent?

Mr. EWING. Yes; it would be minimized to that extent.

The CHAIRMAN. That is, if we compel them by law to use the other devices?

Mr. EWING. Yes; and they would quickly enough use them if they could, because it is highly desirable. Secrecy of communication would be of vast advantage commercially.

There is one other thing I would like to say somewhat by way of apology. Ever since I have been on this committee that drafted the bill I have been rather in an attitude of opposition to the Navy Department, which has always been strongly for greater control, and, in fact, for Government ownership, and I wish to say it is not at all from lack of appreciation of some splendid work that the Navy Department has done in this field. But I did not think that the Navy Department, or any department of the Government, is organized for purposes of investigation and development of the sciences and arts such as wireless, and that if the Navy Department gets control of it it is not at all probable the advance will be such as it will be if we can leave the field largely open to private enterprise.

Mr. HARDY. Mr. Commissioner, have you noticed any tendency or disposition or effort toward monopoly in private hands of the control of the wireless?

Mr. EWING. Of course the Marconi Co. tried very hard to maintain a monopoly, but it did not succeed very well with its patents.

Mr. HARDY. Up to now no monopoly has been established?

Mr. EWING. No; there is no monopoly.

Mr. HARDY. And up to now the Government really owns a vast deal more than half of the wireless service of the country, does it not?

Mr. EWING. I am not able to say. Possibly the Department of

Commerce could tell you that. Mr. Chamberlain might answer that for you.

Mr. HARDY. I think, Commander Todd, you said yesterday that the Government's wireless service cost probably ten times as much, did you not, as the private wireless?

Commander TODD. Yes, sir; we have in our stations and we buy the latest apparatus as fast as we can get it, but the commercial stations, the shore stations, do not keep up with progress to the same extent that we do, and I take issue right here with Commissioner Ewing on the subject of the suppression of the art in the Navy Department. We have always been one of the leaders in advancing the art.

Mr. EWING. I said nothing about the Navy Department suppressing the art.

Mr. HARDY. If you were to take the Government out of this business, mainly would not the effort be, for commercial uses especially, to monopolize it by a large enterprise?

Mr. EWING. It might result in one single wireless company controlling the entire business; and if it did, it would be because that was eminently desirable.

Mr. HARDY. Just as combinations in shipping and other things like that?

Mr. EWING. I do not know about that. But if it won out, it would be because the wireless field lent itself to that method of development.

Mr. HARDY. You think, in other words, if it did result in monopoly, it would be best for it to do so?

Mr. EWING. I think it would only result in monopoly if it were best for it to do so.

Mr. HARDY. The two statements are very nearly the same.

Mr. EWING. Well, I think not.

Mr. HARDY. You think it would be best if it did, whether because it was best or not. Now, then, I want to ask you this: Your objection to Government ownership is that if the Government become the owner, then all future development would stop.

Mr. EWING. I think it would check future development.

Mr. HARDY. Have you any reason for thinking that a monopolistic private owner would be any easier for the development, or any better for the development, than a monopolistic government owner?

Mr. EWING. Yes; and I can tell you why.

Mr. HARDY. The outsider could not operate in either case, could he?

Mr. EWING. I will give you my reason, if you want it.

Mr. HARDY. Yes.

Mr. EWING. My reason is that the private owner, whether monopolistic or otherwise, is in business to make money. It is a commercial concern and the problems are treated as commercial problems. Where development is possible, if it pays it will be financed. The men who have displayed talent will be employed for that purpose and will not be assigned to other duties. If the Navy Department has control of the wireless men will be selected according to Navy discipline; a man who has succeeded in one particular line will be transferred to another line simply because of Navy discipline. The men are not selected because they are investigators; they are selected to make naval officers, and the thing is treated as a Navy matter, not as a matter of the development of wireless.

Mr. HARDY. Let me make this suggestion to you and see if you think there is anything in it: As long as there is private competition unquestionably each competitor is seeking to improve his apparatus and instrumentalities, in order, as you say, to make money. But when you get a monopoly isn't it true that a monopoly of any necessity becomes independent of exertion; and isn't it true that many appliances, new inventions, and new patents, have simply been bought out in their infancy and laid on the shelf because the monopolistic interest did not care about disturbing their investments by the introduction of new patents and new processes?

Mr. EWING. I have no doubt that happens.

Mr. HARDY. Now, right along that line, is it not less likely to be true that the Government would lay aside useful patents when it had a monopoly, than the private owners having a monopoly, bearing in mind the necessity for making profits, would lay aside useful patents?

Mr. EWING. I would answer that by saying if the Government had it, I think there would be very much less likelihood of useful patents being developed, because the Government would not treat it as wisely as commercial development would treat it. Let me give you an illustration, if I may.

The CHAIRMAN. I am a member of the Committee on Patents, and I have heard that question mooted often in that committee. There are thousands of patents lying dormant in your office to-day that have been taken over and are controlled by great corporations in this country, the use of which would involve increased expenditure, although they might increase efficiency and cheapness of production, simply because they do not want to involve themselves in the expense of throwing out machinery that is fairly efficient now, or processes that are fairly efficient now; and for that reason the art itself or the development of the interest in it is retarded and inventors are discouraged to that extent. And I can not, to save my life, see any reason why the Navy Department, by its control, or the Government by its control of this art, would be disposed to stifle it. On the other hand I can see every incentive to stimulate and give the inventor every opportunity to develop the art.

Mr. EDMONDS. Mr. Chairman, if I may say something right at this point, if you will bring out that bill I introduced before your Patent Committee, then we won't have any more patents sequestered. I have been trying to get a hearing on it, but have not been able to do so to date.

The CHAIRMAN. You never came before the committee while I was there.

Mr. EWING. If it would make things cheaper, the patents would not be suppressed. If the new suggestion involved scrapping of vast amounts of apparatus and plant, you can not scrap them and say there can be no charge for it—not as a commercial proposition. I know the chief engineer of the American Telegraph & Telephone Co. in New York (I have known him for a great many years), Mr. Carty. He is one of the ablest engineers in the world. Mr. Carty told me himself on one occasion, a good many years ago when I was engaged in some negotiation, that it was only necessary for him to write his name to a statement that by the expenditure of a given sum of money he could save 5 per cent of that amount per

annum in an improvement of the apparatus, and it then became the duty of the financial department of the company to supply him with that money, whether it was a thousand dollars, a million dollars, or ten million dollars. Now, that means commercial development, and there is not a wisely operated commercial concern or branch of business in the world that does not treat the problem of development in that way. But the Government does not treat things in that way; the Government is not a business concern.

Mr. HARDY. Mr. Ewing, right along that line, do you not know hundreds of instances of a private enterprise absolutely keeping new inventions on the shelf for years and years, like the automatic car coupler; and, just like Judge Alexander was saying, that each manager feels an honest pride for different reasons, and one of them, I fancy, is a pride in showing a big income, a net surplus. And is it not almost axiomatic that industries hesitate, as long as possible, about scrapping old apparatus, and putting in new apparatus because of the cost and uncertainty of making new changes, and do they not wait until somebody else, outside, demonstrates the success of the thing and then gobble it up, if they can?

Mr. EWING. That is true of all business—that is always true.

Mr. HARDY. Now, then, I want to ask you if the Government would not be in shape to give the patentee, the inventor, a better showing to make his invention go than these monopolistic interests that put thousands of patents on the shelf every year?

Mr. EWING. Oh, that statement I deny; they do not put thousands of patents on the shelf every year. Thousands of patents go on the shelf every year because thousands of suggestions are made as to changes in business that are not worth the doing, not worth putting into effect.

Mr. HARDY. Do you think everything that is worth anything goes into use right at once?

Mr. EWING. No; because nothing in human life is perfect, and you can not make it so.

Mr. HARDY. What is your opinion as to the statement of Judge Alexander, "That monopolistic business is slow and does suppress useful patents rather than junk old apparatus"?

Mr. EWING. All business is slow to junk old apparatus. Every inventor, who has a new idea, has to fight his way, not only against the manufacturers, but against the people on the street who buy the things.

Mr. HARDY. If he has to go up against a manufacturer, and that manufacturer is a monopolistic private owner, isn't he in harder lines to get a hearing for his invention than if the Government owned it?

Mr. EWING. No, sir; I would very much rather, so far as my own experience is concerned, deal with a private concern than with the Government.

Mr. SAUNDERS. Is it not notorious that all inventors complain, in all parts of the world, that it is difficult to get a sympathetic hearing for their invention than is developed by this process where the Government is in control?

Mr. EWING. I think that is true.

Mr. SAUNDERS. And there is no more complaint against anybody than there is the Navy Department, particularly.

Mr. EDMONDS. I could give you an illustration of that, if you would like to have it.

Mr. GREENE. I will say this, that in my own city, where there is a large manufacturing development, they scrap thousands and thousands of dollars worth of machinery every year, whenever they can find an improvement. They do not take every improvement brought to their attention. And they have just as smart men connected in the manufacture of cotton goods there as anywhere in the world, and they scrap thousands and thousands of dollars worth of machinery. And I have been South, years ago—I have not been of late years, but 30 years ago—and I found in going into a mill, in which a party wanted me to interest northern capital, machines which had been discarded from mills in my own city were being used there. They do not do it now; they use modern machinery; but they did then. And I know they scrap thousands of dollars worth of machinery every year that becomes useless because of improvements that have been brought to their attention.

Mr. HARDY. Those cases, however, Mr. Greene, are cases where strict competition has to be maintained, where they scrap them.

Mr. EWING. I am not at all suggesting that this wireless business will become a monopoly. I do not know anything about it. But my own personal conviction is that it would be an unwise thing to have the Government take it over.

The CHAIRMAN. I am not undertaking to say what the practice is, but I can very clearly see what the motive and policy should be on the part of the Government. It may be narrow and self-centered, and all that, but that is something I do not know anything about.

Mr. EWING. The naval officers—for example, Commander Todd is now in charge of the radio work. Capt. Bullard was the head. I do not suppose Capt. Bullard was ordered off to some other wireless business. They do not pick out a man who distinguishes himself in wireless and say, "You devote your life to wireless"; he has to be a naval officer. But in private life the man devotes his life to it.

The CHAIRMAN. I expect Capt. Bullard has had more experience along that line than any expert here representing the other interests to-day, because, as an agent of this Government, he visited all the wireless stations of Europe and made a special study of them.

Mr. EWING. What is Capt. Bullard engaged in now?

The CHAIRMAN. He has been transferred to some other duties.

Mr. EWING. Yes; exactly. A private concern would not treat a man like that.

Commander TODD. I will have Capt. Bullard here to-morrow.

Mr. EWING. I understand he can come here. But that is the way they are treated by the department, and that is the way the Navy Department has treated everybody. I am not criticizing the Navy Department; they are running their own department. But, as a matter of encouraging scientific investigation, the Government is not a shining success in comparison with private enterprise.

The CHAIRMAN. Yes; but these gentlemen here are not inventors; they are not the men who develop the art. It is the fellow outside, the man who is unknown to it, who develops it.

Mr. EWING. Sometimes.

The CHAIRMAN. And they are the ones we do not restrict. We do not want to hamper them; we want to encourage them.

Mr. EWING. Neither do I wish to hamper them.

The CHAIRMAN. The only point I make is that in the light of past experience, I can not understand why development would not be encouraged even though the Government should control, as well as if in a monopolistic control. Now, here is the Marconi system, and there is another system; they are both powerful systems. I have heard experts say that one was better than the other. Both are trying to get the upper hand.

Mr. EWING. That is a very healthy situation.

Mr. EDMONDS. There is one thing certain, and that is, it will not tend to the development of the wireless for the Government to take over all the wireless stations. I think Mr. Ewing is perfectly right on that, and I think Mr. Ewing's statement is absolutely true, from my personal experience with regard to patents. You can get a patent; it may be a more economical machine, a little bit more economical than the one at present used. I have a case in mind, one of my own, that I have been interested in for some time. But you can not get the customers to scrap millions of dollars worth of material for the sake of putting on something that is a little bit cheaper. You can not do it, because they simply will not. The case I have in mind is an air brake. It is really the same as the Westinghouse air brake and could be built cheaper than the Westinghouse air brake, but there is a question as to the interchangeability of this air brake with the Westinghouse air brake which has not been settled. The railroads have spent hundreds of millions of dollars equipping their entire rolling stock with the Westinghouse air brake to-day, and they can not afford to throw away the air brakes on the cars to-day for the sake of putting on one that could be manufactured for \$5 or \$10 cheaper.

The CHAIRMAN. They could not afford to put it on all, but could they not put the one that is cheaper on the new cars as they are built?

Mr. EDMONDS. They can not because they are not sure that air brake will interchange with the same efficiency with the Westinghouse air brake; and if they put it on, and at some time it should fail to work, there would be a tremendous loss of property and loss of lives on account of that lack of interchange.

STATEMENT OF HON. E. T. CHAMBERLAIN, COMMISSIONER OF NAVIGATION.

Mr. CHAMBERLAIN. Mr. Chairman and gentlemen, I will only take a few moments of your time, as, in a sense, in this particular measure the Department of Commerce is somewhat subordinate. But with your permission I should like to read the letter of the head of the department, Secretary Redfield, because I think that will save time, and it is a concise statement of the reasons why the department favors the measure most earnestly. This is addressed to the chairman of this committee, and reads as follows:

JANUARY 8, 1917.

SIR: The department has received your letter of December 23, inclosing H. R. 19330, a bill to regulate radio communication, and asking me to give your committee the benefit of such suggestions as I may care to make regarding the desirability of enacting the bill into law.

The bill is the result of the deliberations for a year of a committee on which all the departments were represented, created at the request of the Secretary

of the Navy, to revise the act to regulate radio communication, approved August 13, 1912. That act has been enforced economically for four years by the Department of Commerce, with results, in the main, satisfactory. Under its operations the art of radio communication has made material advances, international obligations have been fulfilled, the orderly use of this means of commercial communication have been greatly extended, and the safety of human life at sea—and incidentally of property—has been increased during a period when it has been subject to terrors hitherto incredible. The bulk of the pending bill is a more orderly arrangement of the provisions of the act of 1912, expressed with greater clarity, and modified in details in the light of nearly four years' experience. In addition to these changes, however, the measure involves several matters of prime importance to the present conditions and future development of radio communication under the jurisdiction of the United States, to which I wish to invite special attention.

The principal features of the bill now submitted are the provision in section 5 by which all Government radio stations are to be open to the transaction of general commercial business in competition with radio stations operated by private commercial companies, and the provision in section 6 by which the Navy Department is authorized to purchase at a reasonable valuation any coastal radio station (a station on land or on a permanently moored vessel, used for exchange of correspondence with ships at sea) which the owner may desire to sell.

These two propositions must be read together, as the department would not favor, and assumes that your committee would not care to consider, a proposition to put the Government of the United States, as a permanent policy, into competition with private corporations in the business of exchanging commercial radio messages between ships at sea and coastal stations in the United States. The two propositions taken together contemplate the establishment of a Government monopoly under the Navy Department in the exchange of radio messages between the coasts of the United States and ships at sea through the exclusive ownership and operation of all coastal stations by the Navy Department, except in so far as the other departments of the Government in the discharge of their duties are required to maintain and operate radio stations. The department is disposed to believe that the bill should also provide for the purchase and operation by the Navy Department of very high-powered stations used for transoceanic radio communication between the United States and foreign nations, as, for example, the Sayville and Tuckerton stations connecting the United States with Germany, and stations connecting Hawaii with the Pacific coast and with Asia, because the argument for the ownership by the Government of such stations is even stronger, as events have already demonstrated, than the argument for exclusive Government ownership of coastal stations.

I might add, on that part, that I believe very strongly in that. That is as far as the Secretary cared to go in expressing himself on the way of a suggestion. If a proposition should be advanced to amend the bill to cover that point, as I understand the Secretary of the Navy has already done, why we would be in accord with it, I am very sure.

The bill in effect invites a declaration of general policy by Congress, and if enacted it should be followed by the appropriations required to give it effect. The situation is briefly as follows:

In the interest of safety of life at sea and of commercial intercourse between merchant ships and between merchant ships and the coasts of the world private corporations have established extensive systems of radio communication, and these systems have been extended rapidly, especially under the stress of war. These systems consist of wireless stations on shipboard and wireless stations at suitable points along the coast. The ships of the Navy, of course, are fitted with radio apparatus, and Congress, from time to time, has appropriated funds with which an extensive system of naval wireless stations along the coast has been established and operated by the Navy Department.

These two systems of coastal stations, one owned and operated by the Navy Department and the other by private companies, not only involve an economic waste to the people of the United States, who must support directly or indirectly both of them, but they also at times and in places interfere with each

other and prevent each other from efficient operation, owing to the imperfect development of the art of radio communication. The volume of naval business transacted by the coastal stations of the Navy Department is not sufficient, this department understands, to give profitable employment to those stations in ordinary times, although those stations also transmit and receive messages for this department and all other departments of the Government which own and operate shipping. The coastal stations operated by private corporations, this department understands, do not in themselves transact enough business to be a source of profit to their owners, but are maintained as part of systems embracing both ship and coastal stations. Your committee will doubtless obtain from the Navy Department and from the companies concerned complete information on these matters. If one system of coast stations will suffice to meet the needs of both the commercial public and the Navy Department more effectively and more economically than two or more systems, the department believes that Congress may well take the steps necessary to the ultimate establishment of that one system.

Occupation and complete control by the Navy Department of all coastal stations in the United States communicating with ships at sea would be one of the first and most necessary measures in the event of a war involving the United States. This basic fact can not be overlooked, and its consequences should be forestalled. It involves the employment at a moment's notice of a body of wireless operators, not only highly skilled, but of reliability.

Even during the present European war it has been deemed necessary to subject such stations to a naval censorship, involving the employment of a considerable force of naval officers and enlisted men who do not operate the stations, except at Sayville and Tuckerton, but whose cost is a tax upon the people, while the costs of operating the stations by private concerns remains as before the war. Even in ordinary times Congress has deemed it desirable to establish and maintain a chain of naval stations along the coasts of the United States to permit a direct communication with the fleet and other Government ships through instrumentalities owned and operated by the Government exclusively. These three considerations, (1) the necessity for complete Government possession and operation of coastal stations during war, (2) the need of Government censorship during a war between maritime powers when the United States is not a participant, and (3) the desirability recognized by Congress for some years of direct and independent Government communication at all times with the fleet distinguishes clearly the proposition for Government ownership involved in this bill from suggestions for Government ownership of telegraph, railroads, etc. Furthermore, the Government system and the private systems, in fact, at the present time actually interfere with each other, and each deprives the other to an extent and at various times and places of its full measure of usefulness.

Indeed, to meet this difficulty the bill provides in section 24 that all important seaports and at other places indicated there shall be, under certain conditions, an arbitrary division of time, the Government and private stations each operating only during alternate hours throughout the 24 hours. This plan is offered only as a temporary device, and it will not be contended that it is a permanent and satisfactory solution of a difficulty. Indeed, resort to this device in itself indicates the desirability of one system entirely operated by the Government.

Congress in the original act to regulate radio communication, approved August 13, 1912, foresaw and provided in part against some of the difficulties of present conditions by authorizing, in the eighteenth regulation, the transaction of general commercial business by certain Government stations and by prohibiting or limiting the installation of new private commercial stations in the vicinity of Government stations, and in the twelfth regulation by providing for a division of time. The principles, accordingly, on which the pending bill is based, are not wholly new to our legislation, and the bill is rather an extension of the application of principles in the light of the experience and development of the past four years. The argument for the ownership and operation of all coastal stations in the United States communicating with ships at sea was set forth somewhat fully in the report of the Commissioner of Navigation for 1911 (pp. 56-58).

With the permission of the committee, I would like to incorporate those pages of the 1911 report in the hearing.

The CHAIRMAN. There will be no objection to that, I take it.

Mr. HARDY. I suggest that you might let that report follow after this letter which you are now reading.

Mr. CHAMBERLAIN. Very well.

In details the bill differs from the act of 1912 mainly in the following particulars:

Section 14 specifically authorizes the censorship which it has been found desirable to establish by Executive order during the European war.

Section 5 specifically authorizes the Secretary of Commerce to approve the rates of commercial stations. The London International Radiotelegraphic Convention (art. 10) prescribes that coastal and shipboard rates shall be subject to approval by the Government on which the stations are dependent, and as under the act of 1912 the Secretary of Commerce was authorized to issue licenses and carry out the convention, the approval of rates was held by the department's solicitor to be a necessary incident with implied authority, resulting from the act. Section 5 removes any doubt which may exist on this point.

Section 7 imposes restrictions on the alien ownership of stations operating in the United States, and section 12 restricts the issue of operators' licenses to American citizens except on merchant ships, because in foreign ports American ships which from any cause may lose their American operators may not be able to secure other American operators.

The Department of Commerce recommends the passage of the bill.

Respectfully,

WILLIAM C. REDFIELD, *Secretary.*

Hon. J. W. ALEXANDER,

*Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives, Washington, D. C.*

(The extract from the report of the Commissioner of Navigation for 1911 is as follows:)

GOVERNMENT OWNERSHIP.

The desirability of Federal regulation of radiocommunication compels attention to the essential difference between the relations of wireless telegraphy to the Government of the United States and to the governments of all the other great powers. A brief inspection of the list of wireless shore stations of the world in Appendix M (compiled from the useful list, giving various important details, of the Bureau of Steam Engineering, Navy Department) will well repay any man who desires to acquaint himself with the situation throughout the rest of the world, and in the United States. That glance will show that in virtually every other country and in all the great colonies of European countries the wireless shore stations are owned and operated by the governments, respectively. In Great Britain and Canada there are some commercial wireless coast stations, but it will be noted that the territory which each may cover is also covered by a Government station. Discriminating examination of the list will also disclose a complete cordon of American naval wireless stations around the coast from Maine to New Orleans, branching off to Porto Rico, the naval station at Guantanamo, Cuba, and the Canal Zone, and thence up the Pacific coast to Unalaska and the Pribilof Islands, with "branch lines," so to speak, to Hawaii, Guam, and the Philippines. The Japanese Government carries the principle of government ownership further than European powers, and the Japanese trans-Pacific passenger steamships are equipped with apparatus furnished by the Government and operated by employees of the Government.

The extent of government ownership abroad is due primarily to the fact that wireless telegraphy is operated as a branch of each country's general telegraph system, and the telegraph systems are organized under and managed by the post office departments of each country, respectively, with which they have obvious and necessary connection anywhere.

There is another reason, however, for the extent of government ownership of wireless telegraphic systems. Land-telegraph lines fall entirely within territorial jurisdiction. They can at any time, if necessary, be seized, controlled, or cut off entirely by a simple pair of nippers. While submarine transoceanic cables are under international protection (Navigation Laws, 1911, p. 443), license to establish a cable landing and shore station must be secured from government. In our war with Spain the facility with which ocean cables may

be cut as a measure of offense or defense was repeatedly demonstrated. From its nature, wireless telegraphy pays no heed to territorial boundaries. It can be controlled in event of war, or, even further, in the tense and vital periods of preparation which immediately precede the actual declaration of war, only by the most searching and complete surveillance of government. The reasons for complete government control of wireless coast stations appeal even to the mind to which the general theory of government ownership is objectionable. In the event of war involving the United States—improbable, but still possible—we should find any possible antagonist equipped to-day, and long before a possible declaration, with virtually complete control of all the wireless systems within his jurisdiction.

Our preparation consists of a complete naval coast system, with the admirable interior military system of the Signal Corps, but in addition there are numerous commercial stations of more or less efficiency which would have to be put at least under surveillance and probably would have to be taken over entirely by Government.

In peaceful times, like the present, the commercial system of the United States in respect of wireless telegraphy presents a striking example of economic waste. We have a Government seacoast system, maintained by Congress, so complete that it is within bounds to say that any ship equipped with wireless apparatus under the wireless ship act of 1910 can be in communication with a naval shore station at all times on voyages along the coast between ports 200 miles or more distant. This Government system is duplicated at some points and to a greater or less degree of efficiency by commercial stations owned and operated by four or five corporations. It is no trade secret that thus far these corporations have not declared large dividends. Possibly in some instances the returns have been invested in experiments or improvements; possibly plants have been erected ample to supply a future rather than the present demand, and there may have been even instances where stock has been issued on no more tangible an asset than the ether itself. Waiving the matter of national defense, the dual system of Government and private shore stations means wastefulness to the people of the United States. This waste, from the nature of things, must increase as competing companies extend their plants and duplicate among themselves apparatus, stations, and operators, or one company will in time absorb the others and establish a monopoly.

The situation has been brought home to this bureau in the enforcement of the wireless-ship act. One company, which has equipped many trans-Atlantic steamships, has no Pacific coast stations in the United States. Several other companies have various vessels equipped, but only limited shore facilities. So far as possible Congress has regulated the situation by providing for compulsory interchange between systems, but there can not be cordial cooperation when one company must devote its shore plant, representing considerable investment, to aid a competitor without any shore equipment, in competing with it for business on shipboard. The naval coast stations, in the last analysis, are the immediate guaranty that the law can and will be effective.

In the light of experience it is probable that, if we had now to meet at the beginning the question of land-telegraph lines, the United States would have assumed the ownership and operation of them as other nations have done. Our telegraph systems now represent an immense investment and, even if acquisition were deemed desirable, which is not here for a moment intimated, the cost to the Treasury would be very large. Commercially the wireless systems in the United States are infants. One, for example, with a nominal capital of hundreds of thousands, represents an actual investment of \$30,000. The principal companies at the present time are engaged in expensive litigation over patent rights. That the companies are thus involved is not a reason for taking advantage of weakness and dissension. It is, however, a contributory disclosure of the fact that the actual investments thus far made are small and not yet of assured value.

If it should be deemed desirable for the Government of the United States to acquire the same ownership and control of wireless stations within its limits which other nations have acquired virtually from the outset, that result can be brought about, with adequate consideration for all bona fide investments of individuals, at much less cost and with much less disturbance to the established order of things now than in the course of a few years. There are, of course, some obvious objections to the suggestion, and it may be urged that the course of invention would be hampered by Government ownership. The suggestion, not

recommendation, of Government ownership has been made with diffidence, because it has been forced by experience upon the bureau, at the outset opposed on conviction to the principle involved. The matter is too large and involves too many questions to be the basis of recommendation by an ordinary bureau.

I may say, apropos of the last paragraph of the secretary's letter, that if an amendment is offered to provide that all operators on American ships must be Americans, I want to have a chance to say something on that subject; because, as matters stand, I am very much opposed to any proposition that is going to restrict American ships and make it more difficult to run them than at present. But that may not come up.

Mr. HARDY. I would just like to ask you—you have had a great deal of experience in framing laws, possibly laws along this line?

The CHAIRMAN. He assisted in the framing of the original radio law.

Mr. HARDY. Section five says the Secretary of Commerce shall approve the rates charged by licensed stations open to public correspondence. Do you think that section gives the right to the Secretary of Commerce to fix the rates charged?

Mr. CHAMBERLAIN. To approve.

Mr. HARDY. It just says he shall approve all charges or rates.

Mr. CHAMBERLAIN. The reason that wording is used is because it is the language of the international convention and it seems to me it carries with it the power to fix rates; because if the Secretary does not approve the rate, the license to the station does not issue.

Mr. HARDY. You are aware of the fact that the Interstate Commerce Commission for a number of years after it was created supposed it had the right to fix rates under the phraseology of the bill creating it, and after some 10 years of operation the Supreme Court decided they had no right to fix rates. And then Congress had to amend the act. Don't you think that language, if it is intended to give the Secretary of Commerce the right to fix rates, could be made a whole lot plainer than by just saying he should approve the rates charged by the companies? In other words, he has the right of approval, but he has not any right of fixing rates.

Mr. CHAMBERLAIN. I may say, Judge Hardy, that in the drafting of the bill by this general committee that question was raised. The reason the word "approve" was used is because the international convention, in article 10, reads:

All coastal rates shall be subject to the approval of the Government on which the coastal station is dependent, and shipboard rates to the approval of the Government on which the ship is dependent.

We took the language of the convention. Now the question was raised as to whether that meant to fix the rates, or not, and Mr. Warren, the Assistant Attorney General, for whom we all have very high regard, took the view the use of the word "approve" would carry with it the right to fix, and that it was adequate. But as I am not as familiar with the decisions of the Supreme Court and the operations of the interstate commerce law as I wish I were and as you surely are, I am frank to say I do not know about that.

Mr. BURKE. Isn't it possible, Mr. Commissioner, that the word "approve" may be used by the English in the sense of "fix" and there is a slight distinction in its meaning with us; and why not express that idea in our own language?

Mr. CHAMBERLAIN. That, of course, is quite possible; but the convention—

Mr. BURKE. Suppose you had an ambiguity in it—

Mr. CHAMBERLAIN. If you will pardon me—the original London convention is in French, and that is our translation of it.

The CHAIRMAN. Section 5, the first paragraph, says:

That the Secretary of Commerce shall approve the rates charged by all licensed stations open to public correspondence.

That would refer to other than coastal stations.

Mr. CHAMBERLAIN. Yes: ship and coast as well.

The CHAIRMAN. The second paragraph provides:

The heads of Government departments having jurisdiction over Government land stations and Government ship stations shall, in their discretion, so far as it may be consistent with the transaction of Government business, open such to general public business and shall fix the rates for such service.

Don't you think the meaning of the word "approve" in the first paragraph, to all intents and purposes, is the same as "fix the rates" in the second paragraph?

Mr. CHAMBERLAIN. I think, Judge, if you will allow me, the same word should be used in both cases; otherwise you will create a distinction and differentiate the word "fix" from the word "approve." And I am frank to say I did not know the two words were used: I overlooked the fact. We had a discussion on the fixing of rates by the Secretary of Commerce, but I do not think I paid much attention to that. As originally drawn, we had "fix" in both cases, and somebody suggested "approve."

The CHAIRMAN. In any event, I take it for granted the intent of this is that the same power should exist in each case.

Mr. CHAMBERLAIN. Exactly, and the same word should be used.

The CHAIRMAN. And when a station applies for a license to transact commercial business, the department is given the power to approve the rates. That means fix the rates; it can not have any other meaning.

Mr. HARDY. I would just like to suggest along that line that after long years of litigation about it, the Interstate Commerce Commission was given that authority by language which is unquestionable; and I believe if we pass this bill we ought to incorporate that language.

The CHAIRMAN. I think so, too.

Mr. BURKE. It strikes me, as a country lawyer, that this first paragraph may be construed as regulating such rates as the stations may charge.

(Thereupon, at 11.50 o'clock a. m., the committee adjourned until to-morrow, Saturday, January 13, 1917, at 10 o'clock a. m.)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 13, 1917.

The committee met at 10.30 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. You may proceed, Commander Todd.

Commander TODD. Mr. Chairman, the Commissioner of Navigation was detained to-day and can not continue his testimony before

the committee until Monday, or some later date. With your permission, I will ask you to hear Lieut. Waesche, representing the Treasury Department, the communication officer of the Coast Guard.

STATEMENT OF LIEUT. R. R. WAESCHE, UNITED STATES COAST GUARD.

The CHAIRMAN. Please give the committee your name and official position.

Lieut. WAESCHE. R. R. Waesche, second lieutenant, United States Coast Guard. Of course, as I represent the Treasury Department I am bound more or less by the views of the Secretary, and for that reason I would like to read the letter which the Secretary has addressed to the committee, and that will fully put forth his arguments more clearly and concisely than I could do in my own words. His letter is dated January 5, 1917, and is addressed to the chairman of the Committee on the Merchant Marine and Fisheries, House of Representatives. The letter is as follows:

SIR: I am in receipt of your letter of December 23, 1916, inclosing copy of bill (H. R. 19350) to regulate radio communication, and requesting that the committee be given the benefit of such suggestions as this department may care to make as regards the desirability of enacting the bill into law.

This bill involves the principle of Government ownership of coastal stations, and while it is a move in that direction it does not definitely provide for such Government ownership. It is the belief of this department that the principle of Government ownership of coastal and commercial stations is sound, and it is further believed that the bill should provide for Government ownership rather than treat of this principle in indeterminate fashion. The chief arguments in favor of Government ownership of this public utility are entirely separate and distinct from those in favor of Government ownership of other public utilities, and I desire to particularly emphasize that this letter is not to be taken as indicating in any degree whatever the views of this department concerning the principle of Government ownership in any public utility other than radio communication. It will be noted that radio signals can not be confined to definite channels, but are transmitted through a medium to which no specific title can be conveyed to individuals or corporations, and therefore radio signals are not amenable to the ordinary measures of control. Where two or more stations operate in close proximity as in the case to-day in many places, they mutually interfere—resulting in confusion, the hampering of radio traffic, and embarrassment to vessels in the vicinity depending upon this means of communication. This condition is particularly emphasized in congested commercial districts, such as New York and other important seaports, and it can be effectively obviated only by placing all stations under one control. It therefore appears that to save embarrassment to the Government, to shipping, and maritime interests in general as well as to the public—all due to radio interference—the Government should exercise full control over this means of communication as far as practicable, and this can be effectively accomplished only through Government ownership and operation of all coastal and commercial stations.

Radio apparatus on board ship is the greatest value as providing a means for summoning aid should the vessel be in trouble. When such a distress call is broadcasted, experience has shown that the majority of the ship and shore stations in the vicinity answer the call and attempt to get in communication with the vessel in distress; this results in interference and confusion, and oftentimes causes delay in rendering assistance. This is of vital importance to the Coast Guard, which is charged by law with the duty of rendering assistance to vessels in distress. Should the Government have the monopoly of coastal and commercial stations, this difficulty would readily be overcome.

The Government, through the Navy Department, now operates as a military necessity a chain of radio stations along the coasts of the United States and most of its outlying possessions; commercial companies also operate radio stations. If all these existing coastal, commercial, and Government stations were placed under one management, interference—the basic argument for Govern-

ment ownership—would be reduced to a minimum, first, by discontinuing a number of unnecessary stations, and second, by enforcing the same set of rules and regulations at all stations. It is understood that the existing naval stations and personnel can take over the commercial radio business and handle it, in addition to the official business now carried on, with little if any increase in the expense of maintenance, up-keep, or operation, and that the revenue derived from commercial business, although not sufficient to make the business self-supporting, would materially reduce the operating expenses.

For the purposes of national defense, the enforcement of neutrality, and other military measures, the necessity for Government operation of radio stations is clear, but it is believed the Navy and War Departments can give more detailed views along these lines.

It is believed that the development of radiotelegraphy will not in any way be hindered by the enactment of the bill into law, but that, on the contrary, private enterprises will be stimulated to further effort in overcoming the many difficulties encountered in this means of communication. The scientists of to-day engaged in the solution of these problems are not, as a rule, connected with operating companies.

It is generally admitted by operating companies that the receipts from fees charged for shore to ship business and vice versa are far less than the operating expenses; in fact, are only nominal, and it is believed the handling by the Government of the shore end of communication between ship and shore would relieve operating companies of a burden.

The advantages of Government ownership of radio stations may be summed up as follows:

1. Advantages to the Government:—

(a) More efficient service due to the elimination of interference, and to the fact that the Government operators would be kept busy and in practice.

(b) No confusion in taking charge of and operating all stations in time of war or when military necessity demands.

(c) Less difficulty in enforcing neutrality in so far as it pertains to the radio.

(d) Increase in treasury receipts.

2. Advantages to steamship lines, and other maritime interests and to the public in general, particularly large business concerns:

(a) More efficient service due to 1 (a).

(b) More expeditious rendering of assistance to vessels in distress.

There would be no disadvantages to the Government as the increase in operating expenses over that at present would be practically insignificant. There would be no disadvantages to maritime interests or the general public.

It is therefore recommended that section 6 be amended to read as follows:

That after three months from the passage of this act and at any time within two years after the expiration of said three months, but not longer, the Government, through the Navy Department, shall have authority to acquire by purchase at a reasonable valuation all coastal and commercial stations now in operation in the United States, Alaska, Hawaii, Porto Rico, and the Swan Islands, and no licenses shall be granted to any coastal or commercial station after two years and three months from the date of the passage of this act.

While the bill provides for the licensing of all experiment stations, technical and training school stations, and amateur stations, so far as concerns the transmitting of radio signals, where those signals can be heard beyond State limits, there appears to be no restriction or check of any kind upon stations which are maintained only for receiving radio signals. True, a penalty is provided as punishment for divulging the contents of radio messages, but within range of every coastal, commercial, or Government station there are numbers of amateur receiving stations, any one of which can readily copy radio correspondence and give it to the public or to private persons with little chance of detection. As a military measure in time of war or public peril it is believed necessary to know the location of all receiving stations, and in this connection it is understood the War Department has been embarrassed by such stations along the Mexican border and were put to considerable trouble in locating a number of them. It is therefore recommended that a new section be inserted in the bill, between sections 4 and 5 as follows:

That no receiver, other than those belonging to or operated by the United States, shall be used by any person within the jurisdiction of the United States, to receive any radiogram by means of the apparatus and methods of radio communication unless such receiver is recorded at the Department of Commerce; provided that nothing in this section shall be construed to apply

to a receiver not capable, in the judgment of the Secretary of Commerce, of receiving radiograms to or from points beyond the limits of the State in which said receiver is located. Such record shall be in such form and contain such information as the Secretary of Commerce may by regulation prescribe.

It is believed that provisions in section 12 relative to alien operators should be extended so as to prohibit the employment of alien operators on board merchant vessels of the United States, and it is therefore recommended that the words "that he is a citizen of the United States" be substituted for the words "the country of which he is a citizen," in line 5, section 12; that the words "except for the operation of a station on shipboard" be omitted in lines 15 and 16, section 12; and the following words be inserted after the word "station," in line 19, section 12, namely, "Under regulations prescribed by the Secretary of Commerce, one alien operator may be temporarily employed for service on a merchant vessel of the United States in emergency."

The need for radio legislation at this time is very urgent, and while the bill, if enacted into law as submitted, will be of benefit to the Government and to the public at large, it is earnestly recommended that the bill be strengthened along the lines herein set forth.

Respectfully,

W. G. McADOO, *Secretary.*

To expand a little bit on the letter, I would like to state that while these are the views of the Treasury Department, in view of the fact that the Coast Guard is the only bureau under the Treasury that is interested directly in radio operation and management, these views are also the personal views of the captain commandant of the Coast Guard, as well as my own. I was a representative on the committee that drew up this bill. I believe the necessity for Government ownership from a military standpoint should not be touched upon by myself, as I am not as well able to do that as representatives from the War and Navy Departments, and I will let that go by, as I believe Commander Todd has already put forth very strong arguments. The Secretary's letter is based principally on the matter of interference, and I would like to point out that at important seaports, such as New York, New Orleans, San Francisco, and other places where this interference is so great, we have great trouble in getting our messages through. Now, if all the stations at these points were under one management, the maximum amount of radio work could be put through in the minimum amount of time, and I believe there would be no trouble under such conditions in getting all the radio work through that is required. As it is now, if we send a message to one of our vessels off New York, a cutter, or the derelict destroyer *Seneca*, we never know whether the message is going to be delivered in 1 or 10 hours; whereas if we send it to a cutter off the coast of Maine through the Portland Navy station, or through a station on the Gulf, as at Pensacola, or any other radio station where there is no other station to cause interference, the message goes through in a very short time; a reasonable time. And so, clearly, the delay is due to interference. Of course it might be brought forth that the business at these other stations, such as New York, is greater; but I believe that in the case of the naval stations on the coast, and in the case of our messages particularly (as we have complete cooperation with the Navy), other business would not cause so great a delay. I think it is entirely due to interference.

The coast guard and the Navy cooperate very effectively in despatching information relative to vessels in distress. We have had in effect, and it has been for a year, a plan whereby the coast-guard stations along the coast on the receipt of news relative to a vessel in

distress send that news directly to the nearest Navy radio station. The Navy radio station, without any further orders at all, sends that news to the nearest coast-guard cutter, to the coast-guard superintendent, and coast-guard division commander, and other persons who are interested in getting aid to the vessel in distress as quickly as possible. That plan has worked admirably. It has been in effect for about a year and, as I say, it has worked admirably. In some places we have been hampered a great deal due to interference, and there are a number of cases on record where delay in rendering assistance to vessels in distress has been caused by interference; in other words, the radio stations have not been able to disseminate this information quickly. There is a provision of the London Convention which requires that shipboard stations shall send their messages to the nearest coastal station, provided, I believe, no interference is caused by sending to a more distant station. If the shipboard station uses a wave length of 1,800 meters or greater, they may send to a more distant station. Coast-guard cutters, being small vessels, can not use effectively a wave length of 1,800 meters or greater, and therefore we are more or less bound by the London Convention to send all of our official traffic to the nearest coastal station. As a result official business of the Government has to be carried on at times through commercial stations, to which a charge is attached (of course, only nominal—6 cents a word), when a naval station just a few miles more distant could be communicated with just as well without cost to the Government. It is not only the nominal charge of sending through a commercial station, but also the clerical work involved, accounting, etc., and other little matters that creep in, and also it interferes with this plan of communication now in effect. In other words, while for distress messages the London Convention could be set aside for the time being, in following out this plan of communication for other matters the Navy could not disseminate that information, because their vessel would be nearer another coastal station, probably a commercial station, and the message would have to go through that station.

The CHAIRMAN. That is the reason why you think the Government ought to control that commercial station, is it?

Lieut. WAESCHE. Yes, sir. If the Government controlled that commercial station, we would not have this interference, would not have this accounting, and would get better results, due to this close cooperation and due to their understanding our work, knowing exactly what to do with the messages when they get them, how to handle distress calls, and where our vessels are located, and all that, which would not be possible with the commercial companies. Of course, the commercial companies are also very much interested in rendering assistance to vessels in distress, and I will say they vie with one another and with the Government in doing this work. When a vessel is in distress, of course, it sends out broadcast a distress call, and experience has shown (as set forth in the Secretary's letter) that when that call is sent out all the ships and shore stations in the vicinity immediately open up and try to get into communication with the ship. They all want to be the one to render assistance. Naturally, it is a good idea, in a way, but the result is that they interfere with each other and no news gets through, and everybody has to sit down and wait until the operators get tired and come to

their senses and close up and let some one get through and get the information. As a result there is great delay. Now, if all those stations were under one management, we could have some shore station in control which could control the situation and make everybody keep out. As it is now, there is no controlling authority to say who shall do the work and who shall not do the work.

The CHAIRMAN. Who would determine what authority that should be?

Lieut. WAESCHE. If it was under one management, a shore station—of course, the shore station always has more power than the ship station, and would be in a position to know approximately where the vessel was (at least as well as anybody else) and could take charge of the situation and tell anybody else to keep out while he got the information, and then give instructions as to what should be done. As it is now, there is nobody who has any authority to tell other ships or other stations to keep out and let some one person, some one station, get the information, so that the assistance can be rendered in an expeditious manner.

Mr. EDMONDS. That would only prevent a certain percentage of interference.

Lieut. WAESCHE. It would reduce it, of course.

Mr. EDMONDS. It would reduce it, but the ships at sea would still endeavor to break in, if they could, and if the ship in danger was too far away from the shore station they would break in.

Lieut. WAESCHE. Oh, yes; they would break in, too, but it would prevent the shore stations from breaking in.

Mr. EDMONDS. It would prevent a certain number of stations from interfering; yes.

Lieut. WAESCHE. It would reduce the interference; it would not obviate it entirely.

The CHAIRMAN. It is very important to get the information to the ships as soon as possible, anyhow, to do the rescue work—

Lieut. WAESCHE. But it is not necessary for them to use their transmitters. If a vessel sends out a distress call and a vessel gets in communication with the ship sending the call, she can get in immediate communication with the shore stations; and if the ships won't use their transmitters, without any trouble, they would get all the information they needed.

The Secretary has also, in his letter, touched on the development of the art, and while I am not at all qualified to discuss that subject very comprehensively—and there are many more gentlemen here who will talk later and who will probably give better views along that line—inasmuch as it has already been touched on, I would like to expand on it a little further.

Mr. EDMONDS. Is this the Secretary himself expanding on the art?

Lieut. WAESCHE. This is the Secretary's letter I just read.

Mr. EDMONDS. You say the Secretary himself is expanding on the art?

Lieut. WAESCHE. No; I say I will expand a little bit.

Mr. EDMONDS. Oh, I thought you said the Secretary, and I was wondering if he was an expert.

Lieut. WAESCHE. No.

Mr. BOWERS. You refer to the Coast Guard. Is that a new bureau?

Lieut. WAESCHE. The Revenue-Cutter Service and the Life-Saving Service, about two years ago, were combined and made into a new service called the Coast Guard.

Mr. BOWERS. That is the old Coast Guard Service?

Lieut. WAESCHE. That is the old Life-Saving Service and Cutter Service combined.

The CHAIRMAN. How many vessels are there in that Coast Guard Service?

Lieut. WAESCHE. We have 26 what we call cruising cutters; that is, vessels that cruise the oceans and the Gulf, and I think about 30 to 35 harbor boats and launches. Those figures may not be correct; that is just approximate.

Mr. BOWERS. The revenue cutter *McCullough* is regarded as one of the larger vessels?

Lieut. WAESCHE. The revenue cutter *McCullough* is regarded as one of the larger vessels and is what we call a cruising cutter.

Mr. BOWERS. How many such vessels have you?

Lieut. WAESCHE. About 25 or 26. In view of the fact that the Navy Department is by far the principal user and buyer of radio apparatus and as a military necessity, the Navy Department must have the best apparatus that the market can supply, and as this bill proposes that the Navy Department shall take over only the operating field of radio on the shore end, leaving the entire manufacturing field undisturbed, just as it is to-day, and not interfere at all in the operating field on shipboard, which is the most extensive end of the operating field, it is not exactly understood how the development of the art will be interfered with. Also, the scientists of to-day, as I believe, are mostly with the manufacturing companies (it is natural they should be), the mere fact of the Navy operating the few coastal and commercial stations should make little or no difference in the development of the art, in view of the more extensive field on board ship for operating and the entire manufacturing field, which would be left as it is to-day. Also, in regard to patent rights, which was brought out yesterday, I believe, that tends to show, also, that the development of the art will not be retarded. Also, it must be borne in mind that the Navy Department and War Department, as well as the Bureau of Standards, have experts of no little ability themselves who have done their share in the development of the art so far. And so I would just like to state that I am not convinced in any way at all that the development of the art will be retarded, but believe it will be stimulated.

There was a new point brought forth in the Secretary's letter in regard to the recording of receiving stations. I believe that the amateurs should be interfered with but very little, and the provisions of this paragraph, I believe, will have that effect. I believe the amateurs will not object to it. It is simply a matter of having the Government know where these receiving stations are, and I believe the boys of the country who are interested in this work would be glad and proud to know that their stations were recorded with the Department of Commerce. The object of that section would only be to put an obstacle in the way of undesirable receiving stations. Of course, it will be very difficult to find a receiving station if the owner desires to conceal it. But I believe there should be

something in the law to throw an obstacle in the way, so that undesirable receiving stations would not be operating openly and aboveboard, without any restriction whatsoever.

I will stop here in favor of Capt. Bullard. In regard to the operators on shipboard, I believe Commander Todd has set forth the idea much better than I could, and I would just like to say I am heartily in accord with his views set forth along that line.

Commander Todd. Before introducing Capt. Bullard, I would like to say that in 1912 the radio act under which we are now working was passed by Congress, at the same time the Berlin convention was ratified, and a little later the London convention, which changed the situation very little from what was required by the Berlin convention. With those two coming on—the radio act and the Berlin convention (and it should be remembered there was absolutely no control of radio matters up to that time)—the Government's activities, so far as radio communication was concerned, widened immediately to a tremendous extent. Naturally the Department of Commerce and the Navy Department were most affected, the Department of Commerce because it had the administration of the act and the Navy Department because of the ownership and operation of shore stations and the tremendous number of sets on shipboard. The Navy Department, therefore, had immediately to expand, get up an organization to meet the situation; and the department, wishing to come up to the confidence that Congress expressed in passing this bill in allowing the department to handle commercial business at certain of its stations and giving it such a free hand in radio matters generally in this country, chose Capt. W. H. G. Bullard to organize the service.

In my testimony the first day I have either said very openly or very strongly that we had a certain number of stations working very efficiently and we have an organization to handle the accounts, and we are prepared in every way to expand our activities with very little increase in personnel or trouble in any way. We are prepared to do it right away. In saying that, I was referring to the work of Capt. Bullard, who organized the service, especially chosen for the task, and who carried on the work for three or four years. In the natural course of events, he of course, had to look out for his future and had to go to sea in command of a battleship last July, at which time I relieved him. So Capt. Bullard is really the one in the Navy Department who knows more of the effect of this bill and the stronger ideas contained in the Secretary of the Navy's indorsement of it, than anybody else. I will now ask Capt. Bullard to make his statement to the committee.

STATEMENT OF CAPT. W. H. G. BULLARD, UNITED STATES NAVY.

The CHAIRMAN. Captain, will you give the committee your full name and rank in the Navy?

Capt. BULLARD. William H. G. Bullard, captain, United States Navy, at present commanding the battleship *Arkansas*.

The CHAIRMAN. I will say that Capt. Bullard and I were colleagues in the London Conference on Safety of Life at Sea, and the acquaintance formed there has given me a very high opinion of

Capt. Bullard and I am glad to have him here this morning to give the committee his opinion on this very important bill.

Capt. BULLARD. Only yesterday was it known to me that it was possible for me to attend a hearing before this committee on the subject of this present proposed radio bill, and therefore I have not quite the complete information of what has gone before. So I would prefer, if possible, rather to put myself in the position of answering questions that might be propounded, rather than taking up any thread of the narrative and continuing it. As I say, I am not familiar with the form of procedure that has gone before and have not had time to read over the preceding minutes of the meeting.

The CHAIRMAN. I would say we think it better to let the witness complete his statement, unless some incidental matter comes up, on which a member of the committee may desire to ask some question.

Capt. BULLARD. Yes.

I could make a few preliminary remarks. I may state, at this time, this bill in its present form as presented to the committee for its consideration is the result of the deliberations of representatives of all the departments of the Government—not only the military departments but all the other departments of the Government who are far from approaching it from a military point of view, such as the Departments of Labor, Commerce, Interior, Weather Bureau—all the departments.

The need for this suggested legislation had been very strongly impressed upon me during my official assignment as superintendent of the Naval Radio Service, and I believe it was myself who was the originator of this bill, although I do not claim now at this time to be the author as it now stands. I personally drew up many features which I considered desirable to be incorporated in the bill, and, working along with my assistants, got into shape a suggested act which was proposed with the idea of increasing general Government control, with the basic principle of eliminating interference and touching also on the basic principle of general preparedness for war. That point of view I have had in mind as a military officer for years and, naturally, have been a strong Government person. This bill I took with its provisions to the head of my executive department, the Secretary of the Navy, and on his instructions I was directed to communicate with the other departments of the Government and ask them to cooperate in sending representatives to consider this suggested act which had been drawn up by myself and my assistants. That was, presumably, about 18 months ago. The other departments of the Government readily fell into the idea and each named one or more representatives of their department. I may say here that the Secretary of the Navy said to me personally—but I am not sure in writing—that he would have nothing to do with the bill, nor would he consider it in any way unless it had the full consideration—open consideration—of all the departments of the Government; that he would not at any time think of sending a bill to Congress of this nature without considering the interests of all the departments of the Government. Acting along those lines, different representatives of the departments were appointed, and we met and started to have meetings. As the Navy Department was the real instigator of this

procedure and proposition, I, as representative of the Navy Department, was made chairman of the committee and presided over this committee for more than a year. Meetings were held just as often as we could get the representatives together, and the various sections were considered and others proposed.

This went on until it became necessary for me to give up that duty, when I left in June of this year, and it was turned over to my successor, Commander Todd; since which time, I understand, the committee have continued to hold meetings during the summer, and the result of their deliberations is now in the completed bill that has been presented to your committee for consideration.

I have read the bill carefully, and while I recognize that it is not the bill I and my assistants prepared, I do recognize a great many of its features and I also recognize that it has been improved in very, very many ways; but underlying it all are the basic principles which we first established, which are based, first, purely on the military necessity of being prepared for trouble. Now, we hear considerable about the proposition in regard to these commercial stations, that the Government is in a position to take them over in time of war; but it must be remembered that in times of war, however we deplore it, we do not get all the notice in the world we want; we do not get three or four weeks' notice or we do not get three or four months' notice. It comes on us overnight. And we want to be prepared, to have those stations under our control at all times, so that we will not have to wait, even overnight, to give an order to take them over. That is based on the general subject of national preparedness, and in my opinion is really the vital feature of the bill—to be at all times ready for whatever comes up before us. Of course, I may state that it is part of my education to be prepared for that state of things; and, in stating that, the members of this committee should consider the fact I am a military officer and I can only see this one thing as the result of my training. But I hope my vision is broad enough to see the other points that have been brought up by the other members of the committee, the representatives of what might be called the civilian element of the Government, and we were always patient and lenient in listening to them, with the result this bill has now been brought before you for consideration. There are stations of all kinds, all over the United States, operated by big companies, little companies, and individuals, and it would be a matter of considerable difficulty to take them over suddenly, if we wanted to, in time of war; send Government operators to them with possibly unknown apparatus and unknown localities in which to work; and it would be all confusion. And what we desire is to take them over now, so that we will always be ready. I think one of the strongest points for this so-called Government control, even Government ownership, is the fact that this proposition is quite different from the general proposition of Government ownership of other public utilities, in view of the fact the means by which communication is effected, the atmosphere, is a medium to which title can not be given by anybody or to anybody, and in that respect is quite different from any other form of communication, such as the telegraph, telephone, or cable, where distinct title can be given to the right of way and to the cables themselves, and the material features which can be turned over and deeds given

to the owners. But when we use the atmosphere this is an impossible proposition. It is free to everybody, and thus being free to everybody, it seems to me should be under the control of one management, and the only management that is in a position to control it is the Government.

The bill as drawn is quite different in many respects from the bill as I remember it when I left, and my duties at sea have been such that I have not been able to give it the consideration in its new form that I would like. But I have read it over very carefully and am quite confident that I can give it my entire personal approval and recommendation.

I may say that I have studied this subject for years. As commander Todd said, I was the first superintendent of our radio service and in that capacity acted nearly four years, during which time I had no other thoughts to think of but radio communication, and watched the effect and operation of the present law; and I am sure that anything that Congress could pass would be an improvement over present conditions, as in many cases they could not possibly be worse. I can not see that any proposition along these lines will in any way hinder this art and its development. We have not touched the amateurs in any way, shape, or form. They can go along just as they are now; and there is where the real development starts, although it seems surprising to say, but of these thousands of boys playing and fooling with this apparatus, some one or two will find something worth developing, and they do develop it and then take it to the higher scientists and get them started on it. We do not propose in any way, even if this full proposition went through in accordance with the amendment asked—to take over the high-power stations—to hinder the development of the art, but rather to encourage it.

Then the people and the engineers working along this line would know that here is the one source for their efforts where they can take and market their goods and know that they will be used, because the Government will always have use for the very, very best; and, as a matter of fact, in the Navy Department stations now, I am quite sure, we are well ahead of the art. Our needs now are greater than the present state of the art can furnish, and as a consequence every one is working toward those needs to effect the kind of communication we desire. It is the Navy Department who controls the greater number of stations along the coast and their operation, and it is the Navy Department which sends out in advance what it needs. It publishes broadcast to the engineering radio world the things that it wants, and it is that broadcasting of those needs which starts these people to work; so it hardly seems to me a fair proposition to come in here and say that this thing will stifle the art. We have not been stifling the art in the past; we have been encouraging it, and are encouraging it every day, telling them just what we need, and I am sure, from our operation and experience with it, we know what we want. We go to them and say, "Here is what we want," and they get busy on it. They furnish us with a particular kind of apparatus which will possibly do the work with a fair measure of success, and then the Navy Department turns around and tries to see if it can not get some one else to work along this same line, or to make, possibly, apparatus along the same lines, with the idea of getting

better than the other people and thereby stimulate competition all along the lines.

In many, many instances the result of that has been to get better apparatus by far than we had in the start. So we can never fall behind, and if it is all under one control—as I say, the Government only can and should be in control—all the inventors in this art of radio and all the engineers working at it will know that there is one central office where they can go with their ideas and have encouragement, and where they will feel they can be assured of encouragement.

We have now a provision of law for building a new laboratory under the Bureau of Standards, in which the three departments—the War Department, the Navy Department, and the Department of Commerce—are actively engaged in this research work. We put our own research people up against the outside research people, and it is in that way we hope to gain keen competition; and I feel perfectly confident that in putting this bill into effect it will have the very opposite effect of stifling competition or efforts in the radio world and will certainly increase it.

The CHAIRMAN. Who is the largest purchaser of radio apparatus, the largest user of it—anyone other than the Government?

Capt. BULLARD. From my own point of view and my state of information I say the Navy Department is by far the biggest purchaser of all the apparatus used in the United States, except, possibly, certain large steamship lines, which are required by law to fit their ships with apparatus; but that apparatus is very small, of low power, and has long since been standardized, and there is very little development along the line of ship installation, or very little need for development, except possibly of the receiving line. Outside of that it is the Navy Department and their big stations on shore, as well as their big stations on board ship, which must be provided for battle purposes, which is the biggest purchaser of apparatus, as far as I know, in this country. The manufacturers and all look to the Navy Department as their best, certainly their largest, customer, and it is the Navy Department they try to please.

Mr. EDMONDS. You mean their largest customer—not their best?

Capt. BULLARD. As their largest customer. “Best” possibly is not quite right.

Mr. EDMONDS. Have you any idea what nations control their coastal stations?

Capt. BULLARD. I can not say right offhand, but my impression now and best recollection is—well, the best answer I can give to that is to say that nearly all of them operate their coastal stations. I do not remember any that do not.

Mr. EDMONDS. They do not control inland stations, do they, but just the coastal stations, as proposed in this bill?

Capt. BULLARD. As to inland stations, I am not prepared to give the information, because I do not know; but, through some department or other of the Government—it is some department of the Government that controls it—they are all coming to it fast. Even Great Britain, France, and Germany, of course, and their colonies, which is the biggest portion of Europe.

Mr. EDMONDS. England handles the wireless through its post-office department?

Capt. BULLARD. Through its post-office department; yes.

Mr. EDMONDS. The same as their telegraph?

Capt. BULLARD. Except in war time.

Mr. EDMONDS. Of course, that would be a very unusual condition.

Capt. BULLARD. During this present war the English Admiralty have taken over all wireless stations.

Mr. EDMONDS. Of course, that would be a very unusual condition. I am talking about ordinary times.

Capt. BULLARD. They control it through their post office, the same as they control the telegraph and telephone business, as a medium of communication.

The CHAIRMAN. You investigated the radio service abroad, did you not?

Capt. BULLARD. Yes, sir; I have investigated thoroughly abroad, both by written reports and my personal tours through Europe for that purpose, their high-powered stations, and all are operated by the Government, or, apparently, not directly by the Government, but by Government help to such an extent that the Government controls the operation. It may be private capital that builds them, but they are controlled by the Government, and when it comes down to the last word it means Government ownership. They try and try to explain that that is not the case, but, as a matter of fact, it is the case.

The CHAIRMAN. Aside from the question of whether or not the Government should own the high-power stations on the mainland, what is your view of the Government owning and controlling the radio plants on the island of Porto Rico, the Panama Canal Zone, the Hawaiian Islands, and our insular possessions?

Capt. BULLARD. I think that is absolutely a military necessity, that we control them in those cases, in those positions and localities, and allow nobody else there. They are small islands, most of them, small places, covering small areas, and, as a matter of fact, there is no space for other than Government stations. The Government stations can do the work, and there is no place for other stations; they are not big enough for them to operate.

The present law covers a prohibition against most places, but this act goes further and includes other places, which is most desirable. During my term of administration of the service, we had several communications and requests for permission, coming from different commercial companies, to build commercial stations on the Philippine Islands and also on the Canal Zone. It seems to me that would be the end of all national defense in those places if we allowed big commercial stations to go right up in small places like the Canal Zone, where we have one of the most magnificent stations in the world at Darien, right in the middle of the Canal Zone; and on each end of the Zone we have two very fine stations for ship-to-shore work, which do all the work for all ships passing through the Canal; and are prepared to build others there when commercial necessities demand. And the same way in the Philippines. It was only through the active cooperation of other bureaus and executive departments concerned, particularly the War and Navy Departments, in bringing pressure to bear upon the Philippine government which prevented the erection of two high-powered stations, belonging to

two different companies in the Philippine Islands. This act proposes to make definite a prohibition of that proposition except with the approval of the Philippine government.

The CHAIRMAN. I have received two or three letters from representatives of the amateurs, and they are under the impression that this bill places further restrictions on them than the restrictions now imposed under existing law. If that is true, what are the additional restrictions?

Capt. BULLARD. I think they are quite mistaken. I think this bill does not in any way interfere with their activities or their stations. The only thing I can see which does is the amendment read by Lieut. Waesche, and that proposition was considered by our committee. The military representatives on that committee wished to go further than this amendment submitted by the Treasury Department; they wished to make all those amateur stations have a license; but after considering all angles of that proposition it was determined in no way to disturb the status of the amateur, and to let him go along in the even tenor of his way. But I really believe this amendment submitted by Lieut. Waesche of the Treasury Department is a very good thing, and will simply record where those people are. If a boy has a wireless station, it seems to me it would make him feel proud to know that his station was recorded in some book, file, or correspondence; that at such and such an address he has a little wireless station. That is all that amendment means—that the stations would be recorded—so that the Government would know where, in time of trouble, to make an investigation of those stations. Suppose the stations in the city of Washington were recorded in that way; in a little while an inspector, or one or two inspectors, could go over this whole city and take a look at that little apparatus and say whether or not they were conforming to the law; and I tell you that these boys would feel a little pride in having some one come to them and say "I am a Government inspector. I want to see your wireless station."

They would immediately take him in and show him their station, and the inspector could determine very promptly whether or not the boy was conforming to the law, and the boy is perfectly happy so long as you let him alone and do not do anything to him. If you let them go along they can receive messages from any place. All these little wireless stations around Washington receive messages sent out from Arlington, receive messages going to Berlin, and they could have received the last peace note, if it had gone that way, if they wanted to—nearly all of them. One long note did come from Berlin by wireless, before they began sending them by cable, during my administration, and I know of at least six amateurs in the city of Washington who received that note. It was not a peace note, but an administration note of very great importance. What is there to have prevented any of those six amateurs, if they wanted, from spreading this news all over that the Government does not want to get out?

Of course, you may say that even the recording of these stations would not prevent their doing that, except that the provisions of this act, if they were ever found out, would subject them to a very heavy fine and the confiscation of their property, and that always, of course,

is held up to them; but of course there could be stations that could not be recorded. Even if we made them record their stations people could have stations, and if they did not want to record them they would not have to, and we would have a terrible time to find them—those stations with the little amateur receiving sets, which we do not know anything about, do not know where they are. At the time this war started, when we were putting in our neutrality regulations, we had to send people all over the United States. First one started in Washington, next in Los Angeles, next in Maine, and next in Florida; there were the four corners of the United States where we had to send inspectors to hunt up the so-called suspicious stations. They can exist always; there is no provision of law to stop them; but if we could hold up to them and let them know that if they did receive messages and did divulge them they would be severely punished it might act as a deterrent to their doing so. Those stations are all over the United States, existing in the most remote places. People have in their houses little sets of apparatus—poor sets, most of them—but some of them very elaborate. The jewelers have them for getting the time.

Arlington sends out the time from here as far west as Denver, and all those jewelers have to do is to take down their receiving sets and listen to the time signals and set their chronometers by them. Those are all very proper uses. All they would have to do would be to have their names recorded in the Department of Commerce, that they have a set by which to get the time. Also, in the summertime, when the baseball games are going on all over the world, Arlington, I understand, sends out the baseball scores, and they go down to the post offices at all the four corners of the United States and receive the baseball scores. That is a proper use. Those people could not object to having their names recorded simply so that we would know where to find them, and go and look at them now and then; in case of trouble, for instance, a policeman would know every station on his beat, and, if we wanted to, could make a rapid examination of the stations here in Washington. All that would be necessary would be to send to police headquarters for those people who go out on their different beats.

That is not going as far as making them have a license.

The CHAIRMAN. It does not involve any expense to the amateur to do that?

Capt. BULLARD. Absolutely none.

Mr. EDMONDS. If you took possession of the coastal business, the ship-to-shore business, would you not find there was interference from these high-power plants that were doing an overseas business?

Capt. BULLARD. I think not. That could be arranged, on account of the great distance, by the wave lengths. A low wave length could be used by the coastal stations and a high wave length could be used by the high-power stations.

Mr. EDMONDS. Would not the next thing be that you would come in for authority to take possession of all the high-power stations?

Capt. BULLARD. I believe so eventually; yes. It is all tending to that, in my opinion.

Mr. EDMONDS. In other words, it virtually tends to Government monopoly and the elimination of commercial wireless absolutely?

Capt. BULLARD. Absolute Government monopoly for all purposes; yes.

Mr. EDMONDS. And that would be the next thing we would have to do, if we passed this bill?

Capt. BULLARD. In five or six years from now we would probably be coming back to you again and asking you to extend our control unless in the meantime the art has so advanced that proper means of communication could be kept up absolutely without interference.

Mr. EDMONDS. "Leakage" is the popular term in Congress now.

Mr. SAUNDERS. In this bill before us now there is no Government ownership to that, is there?

Capt. BULLARD. Only to the extent that it is not based on that, although it tends to it, sir. The proposition, as it stands at present, is that the Government stations shall be open to commercial business, which means the Government stations will then be legally and lawfully competing with the present commercial stations. Now, they can go along and operate just as long as they please, as long as no interference takes place; but from my experience they would in a very short time come to the Government and ask them to take those stations off their hands, because it is certainly a well-known matter that their coastal stations are kept up and operated at a loss simply because they are necessary parts in their chain of transmission. It is one of the arguments of these companies that put up coastal stations, that when they furnish ships with apparatus they inform them. "Here is your means of getting messages to the shore—through our coastal stations"; whereas if they had other means of getting to the shore, through the Government stations, they would not have to use that argument.

Mr. SAUNDERS. The theory of the bill is not to forcibly or by any manner of compulsory process take over the wireless.

Capt. BULLARD. Not at all; no, sir.

Mr. SAUNDERS. But it creates conditions under which private operators in course of time will have to give up operations.

Capt. BULLARD. Will have to give up; I should think so; yes, sir. If it had this provision as proposed by this bill approved by Congress, it could then cut the rates so much under the commercial companies that no one would use the commercial companies. There is a proposition to be considered.

Mr. GREENE. The only point, then, I can see about that is that you would practically ruin their business.

Capt. BULLARD. Ruin their business; and that is the reason that is put in there to buy their stations at a fair valuation.

Mr. GREENE. Who is going to make it fair?

Capt. BULLARD. Some commission or somebody that would be appointed by Congress.

Mr. EDMONDS. It would not have any value after it was ruined.

Capt. BULLARD. Of course not.

Mr. BOWERS. The idea is to make the purchase now, because it can be done more cheaply now than later on.

Capt. BULLARD. Than later on; yes.

Mr. BOWERS. I think, if I remember the figures, that one of the experts said that they could be purchased now for about \$400,000, whereas later on they would cost \$4,000,000.

Capt. BULLARD. When we were estimating, we estimated at first on \$250,000, and then added \$150,000 to that for good measure, and said \$400,000 for the stations we then had in mind of taking over.

Mr. BYRNES. That is the coastal stations?

Capt. BULLARD. That is the coastal stations; yes, sir. Of course, when you get into the high-powered stations, that is a different proposition. Then, instead of running into the thousands of dollars, it runs into the millions of dollars.

Mr. BOWERS. Knowing in advance that there was a probability of purchase later on, would there not be a great many people going into the radio business at the present time with the idea of selling out at a profit to the Government at some time in the future?

Capt. BULLARD. There is no reason why they could not, if they wanted to, now. They do not do it because it is a losing proposition. Anyone can go into the radio business now who chooses; but because of the experience of those who have done it, they know it is not profitable.

Mr. BOWERS. But the Government is usually compelled to pay a little more than anyone else when making purchases of this character.

Capt. BULLARD. It might be desirable to buy a radio site, build a station and put up a lot of junk there, and when the Government comes along, sell to the Government. Such an underhand proposition as that might suggest itself to some of them.

Mr. SAUNDERS. As I understand, the situation created by this bill is this, that if we give them the power to operate the Government stations for commercial business, they can then go ahead, because they have a right to do it, and deliberately operate those stations at such a loss as to drive out all commercial competition and in that way compel the commercial stations, as it were, to fall into the Government's hands and thereby practically drive them out of business. That is a possible power that the Government would have under this bill?

Capt. BULLARD. Yes. In mentioning that question of rates, of course, that is not a conceivable proposition that the Government would, I imagine, deliberately go in there and lower the rates for that purpose. The rates as established now for the Government stations and the commercial stations are absolutely the same, so that there is no distinction made.

Mr. SAUNDERS. I am speaking of it as to the power, as to the possibility of the thing.

Capt. BULLARD. Of course Congress always has the power to fix rates.

Mr. EDMONDS. Is that done by an understanding between the Government and the companies?

Capt. BULLARD. Yes; through an understanding of the Government and the companies. That is done for the reason, in the first place, if the Government rates were any higher it would not be any accommodation to the public, and if they were any lower there would be competition, neither of which is desirable.

Mr. EDMONDS. It sounds like it might be an illegal combination in restraint of trade.

Capt. BULLARD. We have no written agreement or anything else; they made their rates first, and the Government simply established its rates to conform to them, without stating any reason.

Mr. EDMONDS. Just a gentleman's agreement.

Capt. BULLARD. Yes.

Mr. SAUNDERS. Under one section the Government is given the right to purchase if the companies choose to sell. That, however, is not a right to condemn or take over at an enforced valuation; they can only buy if the other man wants to sell.

Capt. BULLARD. If the other chooses to sell.

Mr. SAUNDERS. They can not compel the other man to sell.

Capt. BULLARD. Absolutely not; no, sir. They could hold on until judgment day if they want to.

Mr. SAUNDERS. Under the present bill?

Capt. BULLARD. Yes.

Mr. EDMONDS. Are the present private plants so located that they would be of use to the Government?

Capt. BULLARD. In some cases. I imagine if this present bill passes it would be very desirable to redistribute the whole coast, taking up certain stations and eliminating many other stations. There are many stations which, in my opinion, could be absolutely abolished, wiped off, and removed because they would be absolutely useless and in a bad location.

Mr. EDMONDS. If we should put in this bill a provision for the Government to appoint a commission to value these plants and purchase them or agree upon a price for these plants to be purchased by the Government, would that be an advantageous proposition to the Government?

Capt. BULLARD. I think it would help out; it would put everybody on a fair basis and everyone would know just how this value was going to be arrived at.

Mr. EDMONDS. Did your committee consider that proposition when you were going over the bill?

Capt. BULLARD. In an informal way we talked many times about how this could be arrived at. I think it was the consensus of opinion that Congress should appoint a commission to determine, or possibly do it according to the laws of each State, by condemnation proceedings instituted under the laws of each State.

The CHAIRMAN. Under existing law the naval stations can only give a limited commercial service.

Capt. BULLARD. Certain of them can not give any commercial service.

The CHAIRMAN. If we did nothing more than to remove that limitation and permitted all naval stations to do a commercial business at the present rates—if it is true, as you say, that the commercial stations are not operating at a profit now—as a business proposition they would be quite willing for the Government to take over their plants if the Government would take them over at a fair price?

Capt. BULLARD. It looks so; yes. That is the basic principle of this bill.

The CHAIRMAN. That does not involve any conceivable policy on the part of the Government to use the rate-making power to freeze them out.

Capt. BULLARD. Oh, no; no, sir. I did not intend, as I said, to convey the idea that that proposition would come up.

Mr. SAUNDERS. I suppose the question of the chairman is based upon the question I asked. I did not say anything about whether

it is the Government's design to do this, but whether as a result of the power given by this bill the Government could not do it if it chose.

Capt. BULLARD. I think so; I think it could if it chose to do it.

Mr. SAUNDERS. That, I think, is agreed to.

Capt. BULLARD. Yes.

The CHAIRMAN. I think everybody agrees about that.

(Thereupon, at 11.30 o'clock a. m., the committee adjourned until Monday, January 15, 1917, at 10.30 o'clock a. m.)

RADIO COMMUNICATION.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 15, 1917.

The committee reconvened at 10.30 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. Whom will you have heard first, Commander Todd?

Commander TODD. Prof. Marvin, Chief of the Weather Bureau.

STATEMENT OF PROF. CHARLES F. MARVIN, CHIEF OF THE WEATHER BUREAU, DEPARTMENT OF AGRICULTURE.

The CHAIRMAN. Give the stenographer your name and official position.

Mr. MARVIN. Charles F. Marvin, Chief of the Weather Bureau, and a representative of the Department of Agriculture on the inter-departmental board for radio communication. I have not been able to attend the hearings of the committee, and I presume many things I may say will more or less duplicate what has already been said. But it seems proper for me to indicate briefly the relations of the Weather Bureau, and, through the Weather Bureau the Department of Agriculture, to this subject. You all understand something of the activities of the Weather Bureau. The possibilities of those activities are greatly increased by radio communication especially from ship to shore. We are in cooperative relations with the Navy, and we engage the masters of many of the merchant vessels plying the coastal waters, especially of the South Atlantic and Gulf regions, to report their observations of the weather conditions in the mornings and on other occasions, through radio agencies, to the Weather Bureau. From those reports we are able to learn of conditions at sea that could not be secured otherwise. A knowledge of those conditions often enables us to issue information of great value to shipping and commerce. This is especially true during the summer season and for the region of the Caribbean Sea and the Gulf of Mexico. We also have reports from the ocean and coastal waters of the North Pacific and throughout Alaska that are communicated to us through radio agencies. Before the European war we received a number of reports from Siberia and the Far East, but those reports were cut off at the beginning of the war.

Radio communication enables the Weather Bureau to conduct its work in a way which is very important, and therefore we are greatly interested in the fullest possible development of this means of communication.

The general provisions of this bill, as I understand, have been set before you very thoroughly. If I may briefly comment on some points which impress me, I may say, in a general way, that as a member of the interdepartmental committee I have been strongly in favor of the bill in its present form and personally favored much stronger Government control. In regard to the matter of amateurs, about which some seem to be concerned, I feel that no provision of this bill restricts their activities any more than has previously been the case. There is no conscious intent, so far as I know, on the part of any member of the interdepartmental committee to interfere in any way with amateur work. I have an impression that amateurs might be made useful to the Government and to the radio interests in somewhat the same way that the Weather Bureau utilizes the interest of the public in making meteorological observations. There is a great corps of what we call cooperative observers who, out of their interest in meteorology, like to observe and record weather conditions. We encourage that interest and list them in a corps of cooperative observation. They make regular observations of the weather conditions for us in nearly all parts of the country. I see no reason why amateurs might not be enlisted as a corps of cooperative radio operators that at some time might be useful to the Government. The suggestion of listing and recording amateur stations has been made, I believe, and seems to me to be a good thing. You will have their names so that they can be made available on some occasions if need arises.

In regard to Government stations, it seems to me that we can not imagine the Government without some strong command of coastal communication through this new agency of wireless. It seems to me to be a matter of national self-preservation that the Government should have constantly at its command this means of communication along the coast. If it is conceded that such a Government agency of communication should exist, it follows as a necessary corollary that the opportunity to engage in communication and keep the system and the personnel in complete training and in high efficiency must be allowed. That being the case, it seems to me that logically all Government stations must be allowed to transact commercial business. If the stations exist, with no opportunity to engage in commercial business they will never develop to the full measure of efficiency and utility necessary in time of need. In the deliberations of our committee it was found impossible to escape the necessity that Government stations must exist and must be permitted to transact commercial business.

These considerations bring up the question of interference and competition between Government and commercial stations that may be located in the same vicinity. After prolonged study of all of the questions growing out of these matters the committee felt the only recourse was the provision of section 6, which enables the Government to acquire control or possession of the commercial stations that might be willing to sell out. There was no intention in that to drive them out of the business at all, but it was an inevitable situation that the two competing organizations could not exist side by side profitably; and it was only a proper and right view of the situation to offer to buy the commercial stations at a fair valuation.

Of course, that procedure is necessary because of interference as it now exists. We do not know but what some future development of the art may eliminate interference, and if that should come about the present situation would not exist; and this conflict and competition where stations are located side by side would be eliminated if there was some way of eliminating interference. Such a remedy may be discovered in the future and will no doubt be taken care of at the time. As long as interference exists as at present, however, a proper distribution of the stations along the coast will improve conditions. One organization could probably conduct more business by a proper distribution of stations and the elimination of avoidable interference than could be performed by a number of competing organizations trying to work in spite of each other in the same region.

The CHAIRMAN. If you eliminate the unnecessary stations, in other words, at points where there are three or four stations now and all engaged in the same business, the tendency would be to diminish the cost of the service, would it not, and make the installations on ship-board more efficient? In other words, they would be used oftener by those on board ship for communication with the shore, whereas the cost of the service now is high and very few avail themselves of that privilege. Is not that true?

Mr. MARVIN. I think so. The elimination of unnecessary stations would, of course, be accomplished through this Government control of the location of stations on the coast. As matters now stand, there are certain stations that are unnecessary, but it would be very difficult, under existing law or any provision I can think of, to eliminate stations that are now interfering with each other except by voluntary or compulsory sale.

The CHAIRMAN. Even if we were to eliminate the matter of governmental ownership, if they were commercial stations it would be far better that the license to erect a station and operate it should be under Government control so as to prevent duplication and decrease the cause of interference as well?

Mr. MARVIN. Yes, sir; but that would hardly provide, it seems to me, for the necessity for military purposes—

The CHAIRMAN. Oh, no; but I say, if you just lose sight of that, even from the commercial standpoint just to let everybody go in who wants to and put up a station and compete with the other fellow for business and unnecessarily increase the cost of installations and intensify the interference and, as a necessary result, increase the cost of radio telegrams, it would be a bad policy in any event?

Mr. MARVIN. Yes; undoubtedly.

The CHAIRMAN. And yet there is no law now to regulate it?

Mr. MARVIN. No. Certainly it would only make matters worse. In our Weather Bureau work which I mentioned awhile ago, we experience the ill effects of interference in the transmission of weather reports. There was a case reported a short time ago of a vessel trying to communicate its report to a Government coastal station, but could not do so on account of interference with one of the commercial stations operating at the same time. The commercial station was requested to desist, but declined to do so. These weather reports are made up at a certain hour in the morning and have to be forwarded at once. If they are received in time, we utilize them, but if they

are delayed in transmission our forecasts and warnings are issued without the information contained in those messages. And when those cases occur, we do not know what the conditions at sea may be, and very great importance attaches to some of these reports. Naval vessels plying the coast, or merchant vessels, may know of conditions off the coast of which we have no knowledge, and the report from them, in conjunction with reports from our land stations, gives us an idea of meteorological conditions that may enable us to send warnings of immense value to the shipping along the coast; whereas failure of a report of that kind to come through means a serious loss to the interests.

Interference due to too many stations, certainly should not be permitted, and competition should not be permitted to cause failures and delays in the transmission of important messages like weather reports. We want to eliminate that possibility as much as possible by the prevention of the multiplicity of stations and by the distribution of necessary stations in the most advantageous manner.

Some comments have been made in regard to stifling the art; that Government control operates to stifle the art. It seems to me that is a bugaboo; I do not believe you can stifle art in that way. I happen to be a member of the National Advisory Committee on Aeronautics. We have had brought to our attention certain matters of which I am not at liberty to speak in detail but which indicate that the exercise of private monopoly operates to stifle the art and retard the development of important inventions to a far greater degree than would result from Government control of the same matters or of inventions of any kind. I can not be in accord with those who claim that mere Government control and supervision of an activity of this kind is going to stifle the art. Private monopoly may control a situation and be unable or unwilling to develop an invention or an industry themselves and so terrorize—the word “terrorize” is too strong there, perhaps—or hold such a menace in the way of royalties, etc., over other commercial industries wishing to enter the given field of invention and manufacture as to stifle the art far worse than any kind of Government control of wireless or any other invention would exercise. Too much weight must not be placed on the assertion that strong governmental control of a great agency of this sort, which is necessary for the welfare and security of the Nation, is going to stifle the development of the art.

In regard to high-power stations, we feel that that matter, as provided for in the bill, is about the best the committee could do at the time. Personally, I am opposed to allowing the existence of stations that in any sense or under any possible circumstance may become a menace to the National interests in any way. The question of ownership of these stations and all that, is covered in the bill very well and it seems to me the instinct of self-preservation justifies the Government in exercising such a control over stations of this character as will completely prevent their use prejudicially to the interests of the United States at any possible future time.

The Weather Bureau is in cordial cooperative relations with some of the commercial companies operating high-power stations, and I see no reason why such stations may not be organized on some basis of cooperative relations with the Government that would make them

a part of our organization and not permit, possibly, under some exigency that might arise in the future, of an independent use of such stations inimical to the interests of the Nation.

I do not know that I can go into the subject in further detail with any advantage. I have attempted to express the ideas and opinions that guided me in my part in the preparation of the bill. I should be very glad to answer any questions.

The CHAIRMAN. Of course we have insular possessions like Porto Rico and the Hawaiian Islands, and they are regarded as outposts, and we are expending large sums of money on the Hawaiian Islands, for instance, in coast defenses, and the development of the wireless, with a view of making them powerful naval stations. How does it strike you; is it consistent with the purpose for which we are building and maintaining a Navy and developing those stations as great naval bases, to permit commercial companies to maintain even high-powered stations there, or should not that service all be under the absolute control of the Government?

Mr. MARVIN. I favor Government control very strongly and very broadly, Mr. Chairman; but, at the same time, I do not wish to be understood as antagonistic to friendly commercial activity where the two can be carried on side by side. I think this instinct of self-preservation justifies the strictest possible Government control of this situation. If private interests can operate as a part of the system so as to be a real working part of the Federal control, I think private stations would be justified. But where such requirement can not be satisfied, then I think Government control should dominate.

The CHAIRMAN. Don't you think Government control should be enforced in any event; that is, the Government should have the power at any time to take over these stations and control them and regulate them?

Mr. MARVIN. Yes, sir; decidedly so. This bill practically does that much.

The CHAIRMAN. Whether the Government condemns them and takes them over and monopolizes the entire field or not.

Mr. MARVIN. I think that should be so. The serious question is, if they are left as commercial activities, possibly under a foreign control for a time, they may do great injury before Government seizure is exercised, in case of exigency. And therefore the previous complete control and regulation of those things by the Government would be justified I feel. I can imagine, however, that possibly the commercial interests properly conducted might cooperate with the Government.

The CHAIRMAN. Oh, yes.

Mr. MARVIN. To such an extent that absolute out-and-out complete ownership at the present time may be unnecessary.

The CHAIRMAN. No doubt that is true; but the power ought to exist.

Mr. MARVIN. The power should reside with the Government, I think.

The CHAIRMAN. If there are no other questions of Prof. Marvin, who will you have next, Commander Todd?

Commander Todd. I would like the committee to hear next Mr. Denning, of the Post Office Department. If I may say a few words of introduction, the representatives of the Post Office Department on our committee were the First Assistant Postmaster General, Mr. Koons, and the postmaster of the city of Washington, Mr. Chance. On account of pressure of official duties and their lack of specific interest in the details of the bill, they attended very few sessions. Mr. Denning, chief clerk of the Post Office Department, has been designated to speak for that department.

STATEMENT OF MR. WILLIAM I. DENNING, CHIEF CLERK UNITED STATES POST OFFICE DEPARTMENT.

Mr. DENNING. Mr. Chairman and gentlemen of the committee, while the Post Office Department had little active representation on the committee in the preparation of the bill, we are very much interested in its passage. It is somewhat analogous. The position of the Post Office Department in regard to this bill is somewhat analogous to its position with reference to Government control of the telegraph and telephone facilities. It has been charged that in the advocacy of Government ownership of the telegraph system the various Postmasters General have been actuated from political considerations. In that connection I would like to call attention to the fact that it was the Government that first gave a practical demonstration of the telegraph in 1843. There was an appropriation of Congress of \$30,000 for this test, but the telegraph soon passed out of the hands of the Government into the hands of private monopoly. And practically every Postmaster General from that time to the present day has recommended Government control of telegraph lines.

The CHAIRMAN. My attention was diverted for a moment, and I did not get that date. From what time, did you say?

Mr. DENNING. In 1843 the practicability of the electric telegraph was first demonstrated under Government control or Government ownership.

Mr. GREENE. Did I understand you correctly as saying that all Postmasters General from that time have been committed to the proposition of Government control?

Mr. DENNING. No; I say practically all.

Mr. GREENE. What do you mean by "practically all"?

Mr. DENNING. Possibly there have been four or five exceptions. The exceptions were in cases where some Postmaster General held office only a short time; that is, were in office only for a year or two. I do not recall just which ones who held the office for four years did not recommend it, but there were one or two, I think.

Mr. GREENE. Do you recollect any who did?

Mr. DENNING. Who did recommend it?

Mr. GREENE. Yes.

Mr. DENNING. Yes; Postmasters General Howe, Creswell, Wanamaker, Hitchcock, and Burleson. Those are the ones I can recall.

Mr. GREENE. Oh, we can all recall that Postmaster General Burleson is in favor of it, without doubt.

The CHAIRMAN. I can recall very readily Postmaster General Hitchcock, too.

Mr. DENNING. I can put in the record, if you wish, a complete list.

Mr. GREENE. I wish you would do that.

The CHAIRMAN. Yes; I would like to have that go in the record.

Mr. DENNING. We have very complete information on that subject.

The CHAIRMAN. The only three I remember are Wanamaker, Hitchcock, and Burleson, of course.

Mr. DENNING. Postmasters General Howe and Creswell I know of. I can remember those, and I know there were others.

The CHAIRMAN. How long have you been in the service yourself?

Mr. DENNING. I have been in the Postal Service since 1903, and have served in several of its branches. The strategical advantages, from the military standpoint, of Government control of the radio have been well covered, and it is not necessary for the department to go into that feature of it. There is one feature, however, which we deem it our duty to call to the attention of the committee, and that is the provision authorizing the Secretary of Commerce to fix rates and license stations. This seems to us somewhat an inconsistency. The Post Office Department now fixes the rates for telegraph messages sent by the Government on official business handled by companies who have filed their acceptances of the provisions of the act of 1866. There are three wireless companies, also, who have filed acceptances, and rates have been fixed by the Postmaster General.

The CHAIRMAN. In connection with your hearing here, will you incorporate in the record those provisions in the act of 1866? (See pp. 96-97.)

Mr. DENNING. I will, sir. And I want to read, with the permission of the committee, a copy of the letter addressed to the chairman of the committee by the Postmaster General on that subject:

The Postmasters General of the United States who have advocated Government ownership of the telegraph systems of the country are as follows:

Postmaster General Johnson, annual reports of 1845 and 1846.

Postmaster General Randall, annual report of 1867.

Postmaster General Creswell, annual reports of 1869, 1871, 1872, and 1873.

Postmaster General Maynard, annual report of 1880.

Postmaster General Howe, annual report of 1882.

Postmaster General Gresham, annual report of 1883.

Postmaster General Wanamaker, annual reports of 1889, 1890, 1891, and 1892.

Postmaster General Hitchcock, annual report of 1911.

Postmaster General Burleson, annual reports of 1913, 1914, 1915, and 1916; also advocated Government ownership of the telephone systems of the country.

The Presidents of the United States who have advocated Government ownership of the telegraph systems of the country are as follows:

President Grant, message to Congress, 1871.

The CHAIRMAN. I would suggest that I have those letters, and as we only have a few members of the committee present this morning I think it would be better to await a full meeting of the committee to read those letters.

Mr. DENNING. Very well, sir.

The CHAIRMAN. You may incorporate it with your remarks, but we will read all of the letters from the heads of the executive departments when the members of the committee are all present, or nearly so.

(The letter of the Postmaster General is as follows:)

JANUARY 5, 1917.

HON. J. W. ALEXANDER,

*Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives.*

DEAR MR. ALEXANDER: Your letter of the 23d ultimo, transmitting copy of bill H. R. 19350, an act to regulate radio communication, has been received.

It appears from such examination as could be made within a limited time that the general object and purpose of the bill are very meritorious. However, I wish to urge my objection to the provisions of the bill which would give to the Department of Commerce instead of to the Post Office Department jurisdiction over the licensing of commercial stations, the fixing of rates on commercial business, and the promulgation of regulations and their enforcement. In this connection I beg to recommend that the words "Postmaster General" be inserted wherever the words "Secretary of Commerce" appear and that the words "Post Office Department" be substituted for "Department of Commerce" wherever the latter term appears. As bearing upon this matter, attention is invited to the act of Congress approved July 24, 1886, an act to aid in the construction of telegraph lines and to secure to the Government the use of same for postal, military, and other purposes, which provides that telegraph communications between the several departments of the Government of the United States and their officers and agents in their transmission over the lines of any telegraph companies that have accepted the benefits under that act shall be set at rates to be annually fixed by the Postmaster General.

A study of the constitutional purposes of the postal establishment leads to the conviction that the Post Office Department should have control over all means of the communication of intelligence. The first telegraph line in this country was maintained and operated as a part of the Postal Service, and it is to be regretted that Congress on March 4, 1847, saw fit to relinquish this facility to private enterprise. Several Postmasters General have advocated the acquisition of the telegraphs and telephones and their operation by the Government. I have advocated in all my annual reports the Government ownership of these means of electrical communication, and in March, 1914, the Secretary of War recommended the transfer of the Alaskan cables and telegraphs to the Post Office Department, and this department concurred in this recommendation that the Post Office Department be granted authority to take over and operate the telegraph and telephone facilities of not only Alaska, but also Porto Rico and the Hawaiian Islands. This department has each year since I became Postmaster General submitted to the Congress an estimate of \$300,000 to cover the expenses involved in operating the Alaskan and insular services during the first year after their acquisition.

There is now pending before the Congress a bill prepared by Hon. David J. Lewis, a Representative from Maryland, authorizing the Post Office Department to acquire and extend the telephone system of the District of Columbia. I gave my indorsement of this bill, with the suggestion that any surplus accruing in the postal revenues for the fiscal year 1917 may be applied in payment for the properties described in the bill.

There is no essential difference in principle between communication by radio and communication by telegraph or telephone. The fundamental principle involved in all means of electrical communication is the transmission of intelligence, and this is distinctly a postal function and there is no logical or consistent reasoning that will sustain a proposition to place the licensing of stations and the fixing of rates, etc., for one means of electrical communication with another department while jurisdiction to some extent over other means of electrical communication is already lodged with the Post Office Department.

It is therefore recommended that the bill be amended so as to give to the Post Office Department instead of to the Department of Commerce jurisdiction over the licensing of stations, the fixing of rates, etc.

Very sincerely, yours,

A. S. BURLISON,
Postmaster General.

AN ACT To aid in the construction of telegraph lines and to secure to the Government the use of the same for postal, military, and other purposes.

Be it enacted by the Senate and the House of Representatives of the United States of America in Congress assembled, That any telegraph company now organized, or which may hereafter be organized under the laws of any State of

this Union, shall have the right to construct, maintain, and operate lines of telegraph through and over any portion of the public domain of the United States, over and along any of the military or post roads of the United States which have been or may hereafter be declared such by act of Congress, and over, under, or across the navigable streams or waters of the United States: *Provided*, That such lines of telegraph shall be so constructed and maintained as not to obstruct the navigation of such streams and waters, or interfere with the ordinary travel on such military or post roads. And any of said companies shall have the right to take and use from such public lands the necessary stone, timber, and other materials for its posts, piers, stations, and other needful uses in the construction, maintenance, and operation of said lines of telegraph, and may preempt and use such portion of the unoccupied public lands subject to preemption through which its said lines of telegraph may be located as may be necessary for its stations, not exceeding forty acres for each station; but such stations shall not be within fifteen miles of each other.

SEC. 2. *And be it further enacted*, That telegraphic communications between the several departments of the Government of the United States and their officers and agents shall, in their transmission over the lines of any of said companies, have priority over all other business, and shall be sent at rates to be annually fixed by the Postmaster General.

SEC. 3. *And be it further enacted*, That the rights and privileges hereby granted shall not be transferred by any company acting under this act to any other corporation, association, or person: *Provided, however*, That the United States may at any time after the expiration of five years from the date of the passage of this act, for postal, military, or other purposes, purchase all the telegraph lines, property, and effects of any or all of said companies at an appraised value, to be ascertained by five competent, disinterested persons, two of whom shall be selected by the Postmaster General of the United States, two by the company interested, and one by the four so previously selected.

SEC. 4. *And be it further enacted*, That before any telegraph company shall exercise any of the powers or privileges conferred by this act, such company shall file their written acceptance with the Postmaster General of the restrictions and obligations required by this act.

Approved, July 24, 1866.

Mr. DENNING (continuing). About the only other thing I wish to say, Mr. Chairman, in conclusion, is that so far as our information and observation of the work of the Navy Department is concerned, in its development of the art of the radio, we feel that the officers in charge of it deserve the highest commendation. There has been something said, I understand, to the effect that the art would not develop under the Government's control as it would under private control. We, in the Postal Service, who have been in the service a good many years, do not doubt but that if the Government ownership of the telegraph had continued as in the beginning, instead of there being telegraph service and telephone service now only to certain profitable points, there would have been service of both kinds over the same wires to practically every post office. The present operation of the parcel post extends to every post office in the United States, whereas the operation of the express companies does not extend to the unprofitable points. The Postal Service, through public necessity, extends its operation to any point where the people can be served. The Postal Service takes on additional activities, additional postal functions without the enormous economic loss attending the operation of such activities by a separate company. We think the Government control of the radio holds true in the same way, to say nothing of the military necessity for such a move.

That is all I have to say, unless there are some questions.

Mr. SAUNDERS. I notice you refer to the parcel post; do you think there is any real analogy between the addition of the parcel post to

the activities of the Post Office Department, and taking over the wireless?

Mr. DENNING. There is no connection between them.

Mr. SAUNDERS. I say, is there any real analogy from which you can derive any helpful argument? In the parcel post, you had there a force already in operation, had the equipment and the training in connection with its activities; but should you take over this, you would not have those facilities.

Mr. DENNING. Only in this way; we would have those facilities now operated by the Navy Department, the Weather Bureau, and the War Department and a force which, as I understand it, can handle the work in the commercial field with very little extension.

Mr. SAUNDERS. Would any extension or the establishment of stations other than the present stations operated by the War and Navy Departments be necessary, or are they sufficient for the commercial uses of the entire country, having in mind the natural development of the uses of this system?

Mr. DENNING. As to that, I am not prepared to speak. There are certain technical features—

Mr. SAUNDERS. That is the reason I am asking if there is any real analogy between the two situations.

Mr. DENNING. Oh, I think so. The Government now has numerous stations, and this bill proposes to take over certain coastal stations. I understand that the Government now has probably 10 times more invested in wireless apparatus than private enterprises have, and it would not require as large an outlay to take over the commercial field as the commercial field now has invested in it; that is, to operate the commercial field.

Mr. SAUNDERS. Your recommendation as I understand it, then, goes a great deal further than the bill before the committee.

Mr. DENNING. Not at all.

Mr. SAUNDERS. The bill before the committee does not propose to take over the wireless system by the Government.

Mr. DENNING. It proposes to take over, as I understand it, all coastal stations and that the Government shall license certain other stations.

Mr. SAUNDERS. It proposes a regulatory control of the system and provides that the Government may, within a limited period, purchase any plants anybody wants to sell. That is all this bill undertakes to do.

Mr. DENNING. I know that is the provision of the bill. I should have qualified my remarks to conform to what I understand to be the recommendations of the Secretary of the Navy to take over all high-power stations.

Mr. SAUNDERS. That is just what I said—that your recommendation goes very much further than the bill we are considering.

Mr. DENNING. We are not so much concerned as to the individual provisions of the bill as we are to give you our position with reference to Government ownership and control of electrical means of communication.

Mr. SAUNDERS. That is what I was developing—that you go very much further than the bill.

Mr. DENNING. Yes; that is, as far as our position is concerned with reference to the telegraph and telephone.

Mr. SAUNDERS. As I understand, you say some suggestion has been made that the Post Office Department's policy in this matter has been influenced by political considerations?

Mr. DENNING. I could not see how that suggestion could be made, in view of the fact that the Post Office Department has for years past been in favor of the Government ownership and control of the telegraph systems.

Mr. SAUNDERS. I have not seen any suggestion of that sort anywhere. It may be bad judgment on the part of the Post Office Department, but I do not see what politics has to do with it.

Mr. DENNING. The suggestion has been made that the Postmasters General no doubt have been actuated from political considerations in making such recommendation.

Mr. SAUNDERS. I have not seen that, and I am curious to see how that could be worked out in anywise as an explanation of his attitude. The Postmaster General may be mistaken about this as a matter of sound policy. That is quite different. But I do not see how his recommendation could be related to any political advantage to the party to which he belongs.

The CHAIRMAN. I do not suppose anybody with good common sense could find any such advantage; but then I find a good many objections urged to proposed legislation which have no merit in them, and also legislation proposed that has no merit in it. In other words, people's minds operate in various ways.

Mr. GREENE. I think it would give the Postmaster General or any party a big club to take possession of all these facilities, myself.

The CHAIRMAN. I am in favor of the Government taking over the telegraph lines. So far as that is concerned, I am in complete accord with Postmasters General Wanamaker, Hitchcock, and Burleson on that question.

Mr. RODENBERG. I want to go on record as being unalterably opposed to it.

The CHAIRMAN. I do not mean to say for the Government to take over all the general activities of the telegraph companies, but there ought to be an instrument in every post office to either send a letter, a post card, or a message, and there ought to be an operator in every post office, and it ought to be a part of the post-office system. However, that the Government ought to take over the wireless establishment—I am not prepared to say as to that. That is a different proposition.

Mr. SAUNDERS. I was just going to say, on this matter of the suggestion that the attitude of the Post Office Department having emanated from political considerations, from the point of view of politics it seems to me it would be a very unprofitable thing for the Democrats to be related to it.

Mr. RODENBERG. It would be a disadvantage, from my point of view.

Mr. SAUNDERS. Yes.

Mr. DENNING. If I may make one further suggestion, possibly my statement in the matter has not been clearly understood in regard to the department's recommendation relative to the telegraph and telephone. The Government now has a monopoly over the transmission of letter mail, or first-class mail; that is, the transmission of intelligence so far as it is handled by means other than by wires.

or electrical means. There have been numerous authorities who contend that there is no essential difference in the transmission of intelligence by wires and its transmission by means of carriers, and that the Government should have control over all means of the transmission of intelligence, regardless of the manner in which it is carried or sent. If we advocate Government ownership of electrical means of communication by telegraph and telephone, it is logical for us to urge Government ownership and control of the transmission of intelligence by wireless.

Mr. HADLEY. The Government, however, does not own the main arteries which transport the mail.

Mr. DENNING. But they are under the control of the Government.

Mr. RODENBERG. Yes; but to follow your argument to a logical conclusion you ought to advocate Government ownership of the railroads and everything else.

Mr. DENNING. Not at all, sir. We have the control. The agencies for the handling of mail are under the control of the Government.

Mr. GREENE. Mr. Chairman, as I understood it, the Navy Department and the War Department were interested in this radio matter as a matter of maintaining neutrality in our present troubles.

The CHAIRMAN. And for the national defense.

Mr. GREENE. Yes; and for the national defense. I did not understand we were to open up the theory of all the departments entirely outside of what we have under consideration now.

Mr. RODENBERG. I think it ought to be limited to the bill.

Mr. GREENE. If we are going to spend our time in getting this bill in shape I think we ought not to take on too many theoretical propositions outside of it, because we will get far afield.

Mr. HADLEY. I am frank to say the introduction of that collateral testimony will have no weight with me in a way that will tend to prejudice this bill in my mind.

Mr. GREENE. I think we ought to confine ourselves to this bill or nothing. If we are going into everything else, we shall not have anything in this bill.

The CHAIRMAN. I have read the letter of the Postmaster General. He is in accord with all the provisions of this bill; but he says he thinks the Post Office should take over the wireless instead of the Department of Commerce.

Mr. GREENE. Oh, yes; we know that very well.

The CHAIRMAN. Of course, the question of Government ownership of the telegraph is merely an incident.

Mr. GREENE. It is outside of this proposition we have before us.

The CHAIRMAN. Yes. I think they rest on an entirely different basis myself.

Is there anything further from Mr. Denning? If not, who will you have, Commander Todd?

Commander TODD. Will the committee listen to some further remarks from Capt. Bullard on the subject of neutrality?

The CHAIRMAN. Yes.

STATEMENT OF CAPT. W. H. G. BULLARD, UNITED STATES NAVY.

Capt. BULLARD. I should like to continue my remarks of Saturday with a little further amplification of the relation of this bill to amateurs.

The CHAIRMAN. I do not know, Capt. Bullard, whether some of these gentlemen were here on Saturday when you made your statement. You were chief of the Wireless Bureau in the Navy Department for how many years?

Capt. BULLARD. For practically four years; from its inception, until June—three years and nine months, practically.

The CHAIRMAN. And in June last you were ordered to sea, and are now in command of the battleship *Arkansas*?

Capt. BULLARD. Yes. It seems that there is such a consistent effort on the part of certain interests to protect the interests of the amateurs and in which principle I am in thorough accord, I would simply like to put in the hearings a few more words which will show, I think, that the object of this bill and our past relations with the amateurs is such that far from attempting to hurt or injure the amateurs, we are doing everything possible in the way of their up-building in their chosen profession of playing amateur with this high science and art.

All the amateurs, practically, on this coast are now recorded as far as we know them and can get hold of them in the office of the director of naval communications. Those amateurs are divided up into districts, under our district superintendents, and each amateur station has been, so far as we can, communicated with with an idea of asking their cooperation in time of trouble and to what extent they can help. This has been suggested to me by the statement of Prof. Marvin as to certain things which could be done in cooperation with the amateurs. This, I am glad to say, has been done, and there is now on file in the office of Commander Todd all this information. Take the district of New England, for instance, which embraces from Eastport to a station halfway down Long Island Sound: In that district every amateur known to exist has been communicated with and asked the status of his station, its power, its receiving and transmitting qualities, and that is a matter of record; and each one of those amateurs has been given a certain naval station with which to communicate if they have any information which they think would be of value to the Government. For instance, the Maine stations would communicate, if they are sufficiently powerful, with the station at Portland; if they are not powerful enough, they are authorized to communicate by telegraph, telephone, or mail any information which they think may be of value to the Government.

You must understand this is an organization for war time, and it is tested out periodically in times of peace. What we do is to mobilize those stations, so to speak, and put them on a war basis, say, for a week. Then these little stations imagine that they have seen something out of the way, or imagine that they have news, what we call constructive war news, which is passed on to that little station by us, and that station passes it on to the office here under the operation of the Navy Department. So these amateurs are taken care of and organized now; and as more of them come in, we get in touch with them and, as I say, we already have a record of their stations, what they can do, how far they can reach, and we give them the character of work which is commensurate with their power and ability. I have no doubt it would be interesting to the members of the committee to know that among these amateurs are several of the female species who have volunteered their stations, and quite a few

of those women take a pride in this and have joined this organization voluntarily.

In addition to this, as superintendent of our service, I had the pleasure of accepting honorary membership, as vice president, of two of the biggest amateur wireless associations in the United States, and I have no doubt but that my successor has been asked to serve also in that capacity. I bring this out to show that there has been no effort on the part of the Government to discourage in any way, but it has been our one ambition to build up and show where they can do better and increase the national organization for national defense. These volunteers in this organization all have complete instructions. Further than that, many of them—and when I say many I mean a great many—have volunteered to enlist for such period as the Government may desire in times of war and trouble. Those names are kept on file. Many of them have joined one or more of the various forms of fleet reserve which were brought into being by the last naval appropriation act in the last Congress. They are enrolled and some of them are now going to sea. They serve for one or two months each year on board of one of our seagoing ships, and at other stations, and they are getting the practice necessary to train them to carry on the Government's work.

That is simply to show that, as far as the Navy is concerned, its activities are toward the uplift of the amateurs and not to destroy them in any way; and we can not see that this bill is in any way going to interfere with their activities at all.

Now, I should like to call your attention to one or two sections of this bill that relate in a general way to the question of neutrality. I think sections 14 and 15, and a further section later on, relate somewhat along that line, section 25. It may be said that this question of introducing sections into this bill relating to the general broad question of neutrality probably met with greater trouble than almost any section of the bill. Among the members of the committee which drew up this bill was Mr. Warren, one of the assistant attorney generals of the Department of Justice, who lent us every possible means at his command in order that the language should be properly drawn up as relating to the legal phrases, definitions, and so on. I think it was rather the attempt of the committee at that time to sidestep the question of such acts and parts of acts as are taken care of in sections 14 and 15, with the idea that the Department of Justice would offer a general blanket bill covering all phases of the neutrality question; but they were so overwhelmed with work that they could not apparently get to that proposition, so we decided rather than have nothing we would have a little in here, if we could get it, relating to the general questions of neutrality and violations of neutrality.

There are very few acts on our law books that relate in any way to punishments for the commission of crimes against neutrality. Questions relating to that have been left in the hands of the executive departments of the Government. There is nothing I know of now on the statute books that defines what are offenses against the neutrality of the country; probably the lawmakers believing the proper place to leave that was in the hands of the executive departments of the Government, particularly the President. These sections are de-

signed somewhat to cover propositions that have come up in the past—sections 14 and 15. There was a section in the original bill which gave the President authority under certain conditions to close stations by Executive order or turn them over to any department of the Government for use; but conditions have arisen during the past year when that act was in effect when the President himself felt he should go further, and he issued a general order in a proclamation. And in that general order or proclamation relating to neutrality certain regulations were drawn up as affecting neutrality concerned with the transmission of messages to ships at sea.

It is a matter of record that the Navy Department now, under that President's Executive order, is operating two of the highest-powered stations in the United States, one situated at Tuckerton, N. J., and the other at Sayville, on Long Island, about halfway down the island. These two stations are very fine stations, high-powered stations, which were designed to communicate with the Continent of Europe and which daily do so, day and night—communicate with corresponding stations in Germany. It might be of interest to remark here they were German stations built on this coast, built by German capital and operated by German operators, all of which we have strived to correct in this bill by provisions which prevent certain ownerships of stock by aliens, and all that sort of thing, which you can read through here. We have, in fact, although they deny it, the proposition of representatives of a foreign Government coming right over into our country, building these high-powered stations directly under laws and regulations that are drawn up by their own Government. Can anyone imagine what would be the effect if an American corporation or individual should go to Germany and buy land and put up a high-powered station there? What would be the effect? He would be shown the front door out of the country; and yet there is no provision of law now to prevent any person in the world coming into this country, acquiring real estate and building these high-powered stations, and practically operating under German or other laws. I do not use this word "German" in any offensive manner; simply because those two stations are now operated and generally known as German stations.

Mr. RODENBERG. How many foreign-owned stations are there in this country that you know of?

Capt. BULLARD. That expression "foreign-owned"—

Mr. RODENBERG. Owned by foreign interests?

Capt. BULLARD. I could not say, because really, under the operation of our laws, there are no foreign-owned stations. They must form an American company, you see, before they can apply for and obtain a license, and so they are American owned. Therefore, they get around this proposition, and it is very difficult to say what are foreign-owned or foreign-controlled. They form American companies to take over the holdings of the European companies, and those American companies apply for the license. So, on the face of it, they are American companies; although, as a matter of fact, they are not—their capital stock is still held abroad and their policy is determined abroad.

Mr. RODENBERG. You do not know how many stations, then, have been capitalized by Europeans?

Capt. BULLARD. No; I could not say any more than these two particular stations that I know of, Tuckerton and Sayville. Those two stations are admittedly so capitalized. They were admittedly built by foreign capital and officered by foreign citizens. Each, however, formed an American company, and I can say now, and I believe with full credit to the company operating the Sayville station, that they all claim to be full American citizens. Those who were not American citizens at the outbreak of the war have since become naturalized American citizens, and I believe that it is a question of pride with them now to claim that they are fully naturalized American citizens and imbued with that spirit which should go with American citizenship; but certainly that was not the case when that station was built, and of course it is a question of doubt as to how far their policy still continues to be controlled by the company that gave them support and gave them the money to build the station in the first place.

The Navy Department, at the beginning of the war, felt that it was necessary in the interests of our neutrality to take over the operation of the Tuckerton station. The history of this station is unique in the fact that its ownership was in doubt and is still in doubt and is the subject of a suit in one of the United States courts in New Jersey. The land, so far as our investigation shows, on which this station is built, is owned by a German citizen, a German subject, who now resides in Germany. Under the laws of New Jersey an alien is allowed to own land in New Jersey, and this land is held in fee by this individual. On this land was built this station, and after it was built by this German money and German patents and German apparatus installed—after this station was built they were approached by a French company with a proposition to buy the station. A contract was drawn up to purchase this station and this German station was erected with the understanding that the French company should pay annual installments as the station went up, withholding the last payment until a final acceptance trial was made and it was in successful operation. Our best information is this French company had paid before the outbreak of the war 90 per cent of the value of the station—the other 10 per cent to be held in abeyance until the station had successfully made its trials, which was the transmission and reception of so many words per minute across the Atlantic with the corresponding station in Germany. At the outbreak of the war this, of course, was all changed, and this has now become a question of dispute between German and French subjects in our own territory right in the heart of our most populous district. These Germans were still in possession as being the constructing contractors. They were in possession, and they refused to give up possession. The representatives of the French company agreed to waive the proposition of having these tests and offered them the remaining 10 per cent of their price so they could have a French officer in command; but the German representatives in charge refused to move, and they have since successfully refused to move, and are still there as the representatives of the German company.

In order for this station to do business at all under the present radio act it is required to have a license from the Department of

Commerce. Knowing foreign companies could not get a license they each went to the extent of forming American companies, which they could conveniently do by getting certain kinds of American citizens to serve as officers of the American concerns with different names, with different officers and everything else, and title turned over to them, and then those two American companies, one representing the German side and one representing the French side, applied for a license to operate the station. That was done. Those two American companies then applied to the Department of Commerce for a license to operate that station, and the Secretary of Commerce, on learning the circumstances, very properly refused to issue the license to either of these contestants.

Then the question came up what should be done with this beautiful station that could communicate with Germany when there was no one authorized or could be given a license to operate it. It was then that the Navy Department stepped in and said, with the approval of the other departments and under the President's proclamation, that the Navy Department would operate the station if it was agreeable to the other departments concerned. As it seemed at that time the Navy Department was the only one which had the organization ready and the operators ready to take over the operation of that station, on approval of the President that was done. The Navy Department then sent an officer and operators to the Tuckerton station to operate it, as it was felt it would be a shame to allow this beautiful station to lie idle when all other means of communication with Germany were broken and this was the only means left. The cable to Germany had been cut and Germany was without any communication, and rather than have no communication this station was operated and is still being operated by the Navy Department.

Now, the question of ownership of the station is still in dispute and is still a subject of litigation before the courts. The station is operated under regulations and instructions drawn up by the Navy Department, so that for its neutrality purposes and for its ordinary purposes the organization, administration, and accounting for the money that is taken in as the earnings of the station are held in trust by the Navy Department, to be finally turned over to whichever company is decided to be the right owner of the station; and we can say, with a feeling of pride, that whoever will get this station finally will find a very handsome nestegg awaiting them in the Treasury of the United States; and I can also say with a feeling of pride that in the administration of that service up to the time I left, if my memory serves me right, we had operated that station for whoever may be determined hereafter to be the rightful owner, taking into account all overhead charges, running expenses, and so forth, and appraising their station at \$400,000 (which was quite a big value), and had cleared, I think, if my memory serves me right, and were ready to turn over 30 per cent of the investment to the owners. So it can be seen that our stewardship has been a success and a good one.

I simply mention this to show the fact that the Navy Department is in a position to do that with all stations or any stations, on account of its thorough organization and the administrative details which it

has worked out. This station, as I say, was taken over to preserve our neutrality, in order that there would be some one there to prevent unneutral messages being sent to ships at sea so that they could be picked up by belligerent vessels to their own advantage; and we confidently hope that station has not been engaged in sending any unneutral messages.

The operation of Sayville was somewhat along the same lines. Sayville was a station which was in operation before the beginning of the war, but it was not quite powerful enough to reach Germany under all conditions, especially during the summer season, when the static disturbances in the atmosphere are very severe. The operating department of their company applied to the Department of Commerce to put in better apparatus and a higher power. This was done. The Department of Commerce very properly conceived the idea that this was, in effect, the building of a new station and therefore became subject to a new license, and when the time came for them to apply for a new license the Department of Commerce, for reasons developed in conference between the Secretary of Commerce, the Secretary of the Navy, and some of the other executive officers, refused a license to Sayville. It had been under strong suspicion that many unneutral messages had been sent from Sayville and outside interests were brought to bear, and the interests of the Government seemed to indicate it would be a part of wisdom for the Government to take over Sayville and operate it as it had operated Tuckerton. It was taken over under the same conditions as Tuckerton, with the exception of the accounting features. As there was no question of ownership the money accruing as earnings had to go directly to the Sayville station, and the Navy was only concerned in operating it and furnishing the officers and men to do this, and to see that the neutrality proclamation of the President was distinctly carried out.

Now it becomes necessary—and that is the excuse for putting in these sections 14 and 15 here, which I think all agree, possibly, are very necessary to cover these difficulties we have met with in the past, and, as I say, there is one other section, 25, that relates somewhat along that line, although it does not say so—to provide:

That whoever, including any person in the service of the Government, shall knowingly transmit or publish, or knowingly cause to be transmitted or published, any false or fraudulent distress radiogram, or who, when engaged in radio communication shall transmit or publish, or cause to be transmitted or published, any other radiogram for the purpose of defrauding or deceiving the Government, shall be punished by a fine not exceeding \$2,000.

And so on.

Now the words “any other radiogram, for the purpose of defrauding or deceiving the Government,” that was put in there to make our neutrality regulations a little bit stronger. If my memory serves me right this was brought about by certain cases where messages had been sent which were apparently in plain English and apparently had no relation to any proposition, and yet were intended to and did deceive and defraud the Government. I can recall one instance of a ship which was sailing from New York carrying certain apparatus as a part of her cargo, and when she was out at sea the owner or agent on board sent back a message to the owner or agent on shore as to what the disposition of certain parts in this country had

been. The naval censor at the station through which this message passed became suspicious of this message and refused to pass it unless he had further authority from the Navy Department. He communicated further with the censor we had here, and the answer was that this message related to machines having to do with the Red Cross, I think. Still this young naval censor of this station was suspicious for some reason or other—apparently he was of a suspicious nature—and he refused to pass the message at all. He telegraphed to the Navy Department and, unfortunately, addressed his telegram to the Secretary of the Navy, which is quite an unusual procedure.

The Secretary of the Navy received this telegram in his home at an hour when he was unaccustomed to receiving telegrams. As far as he could see at that time there was no reason for holding up the message, and he simply had a message sent back to pass the message, and it was passed. Further investigation developed that those machines for Red Cross use turned out to be flying machines for use of one of the belligerent powers, which were shipped from Canada over into the United States and put aboard at New York and went out on this ship.

Now these messages that he sent back; they were not messages that contained, apparently, anything that constituted a violation of our neutrality, and they were true messages as far as they were received, but they were intended to deceive and defraud the Government of the United States; and in this case they did succeed in defrauding and deceiving, although the messages themselves were in plain English; but apparently they conformed to some code with the agent on shore, although the agent on shore was not quite sure of his code, because he was the one who gave the whole thing away. He said he was not quite in accord with the agent on ship and did not understand, and came out and said that these were flying machines intended for one of the belligerents.

The CHAIRMAN. Instead of machines for the Red Cross?

Capt. BULLARD. Yes. So this was put in there for that purpose. And there are many other complaints filed in the Department of Justice that would be covered by that very language, of messages intended to deceive and defraud, although they may be perfectly clear, plain English messages. Of course, if a person can send an English message through, carrying a hidden code, all well and good; they are just that much smarter than those who receive them, and we can not get hold of them; but if it can be proved that they are intended to deceive and defraud then we can get some hold on them.

It happens to be a matter of record at the present time that one of the English ships just entering the English Channel was turned back by a message sent by somebody on shore to the effect that the captain had the measles. That was a very plain message, and yet that measles proposition meant to that captain that war was declared, and to proceed to a point of safety immediately. Those are just little illustrations of events that have come to us in the past years in trying to take care of our neutrality proclamation, and which at present is not a subject of law, and, I think, in many cases is properly not a subject of law; because if it were then we would just be tied down to

legal expressions, whereas if it is left as at present, of course the Executive can handle it in a bigger way. These two sections were put in here on the recommendation of the committee to cover just the few points that have not been brought out. It was the intent, as I said, to leave these out and to put in one general blanket neutrality act, which the Department of Justice proposed to draw up and submit to the present Congress; but they never got that far, and did not do it, and the committee, feeling that this matter of radio neutrality should be protected in some way, included those three sections in here. That is the excuse for these sections being in here at this time.

The other sections relating to the divulgence of messages, and so on, are practically the same as in the present act, and contain no changes. I notice these are the only ones.

Of course, the operation and administration of the radio service is so filled with many examples of complex propositions that I could continue to talk for days just in the conversational line I am now without bringing up any argument for the particular features of this bill, but I want to continue to go on record as being strongly in favor of the bill, and say it has only been drawn up after very, very careful consideration; that we have seen those things operating and have been perfectly helpless to correct them, and we have come to Congress and asked for these things which we think will correct that situation and provide proper control and proper regulation of this art that uses the one common atmosphere for its transmission, and in which we do not believe title should be given to anybody to use except the General Government.

If my information is correct, it has been suggested that an amendment be added to the bill which goes a little further than the bill does. I might say, with all due deference to my conferees and those with whom I worked, that I personally can not bring myself to see that that will be a desirable feature at this time.

Mr. GREENE. To what do you refer there?

Capt. BULLARD. The acquirement of the high-powered stations. Although I believe, and can not help from believing, that would come in time if this bill became a law; yet it seems to me it is not quite the time to make that a matter of national legislation. And I can not get myself in accord with some of my conferees along that line, and I believe the bill, as it stands, is as near a perfect solution of our proposition as we could desire at this time. I say that from the fact that we do not propose, as I have tried clearly to bring out, to touch the amateurs, which is the class that use low-wave lengths and very low power. Then we go up to the middle class, which is the coastal communication, which uses a medium wave length. That is required by our international obligations under the London Convention of 1912. And where we use a moderate power, that is the place we think we should step in and take control, and possibly ownership, for the reason that the apparatus has, to a certain extent, been more or less standardized; the regulations of the world have provided the standards, and there seems very little chance for improvement along that line except possibly in receiving sets that may be designed in the way of better selectivity and which will answer better to sharper tuning. Now, when you get outside of that, you get into the realm of the high-powered stations and long wave lengths, where the real

engineers and scientists are concerned in the development of the art, and leaving out the amateurs that are away down on the scale. And I believe that region up there of the long-wave length and high power should be left for the scientists and engineers to play with as they see fit, under proper regulation, which this bill gives, and which regulates certain wave lengths which are theirs to use.

We have seen recently the development of a wireless telephone. That is in that region up there of high power and long-wave length. And there are many other instances of the development of the art that will come along that will readily find their way into that space. So, I would say I consider that space should be left for the scientists, the experimenter, and the engineer, because they are the unknown depths in which they can experiment and develop and carry out their researches as they see fit. But this medium region, which is the one for communication with ships at sea, has been more or less standardized, and there is very little chance for change in there, except along the lines which I explained, of developing a little better selectivity in transmission and receiving. The receiving has possibly been developed as far as it can. And there is the place where I think the Government can properly step in and take over the control absolutely, leaving the two extremes open. The amateur it does not disturb at all, and the field of the long-wave length is left for the radio scientist, engineer, and research man to play with as he sees fit.

Mr. HADLEY. You believe that if the high-power stations were left outstanding, they would not be a menace to the national security?

Capt. BULLARD. Not under the provisions and regulations provided in this bill; but I do believe it would tend in the future to gravitate toward general Government ownership, but not necessarily at this time. It might not be for years, during which time many new devices might be developed up in that region.

The CHAIRMAN. This bill provides that in the event of war or in time of public danger or disaster all stations may be taken over.

Capt. BULLARD. Oh, yes; to be taken over in time of war or public danger; and that is properly taken care of under this bill.

The CHAIRMAN. Not taken over permanently, but taken over and dismantled for the time being and placed under the direct supervision and control of the Government.

Capt. BULLARD. Exactly.

Mr. HADLEY. That would be a temporary taking over for war purposes?

Capt. BULLARD. A temporary taking over for war purposes.

Mr. HADLEY. Whereas the amendment proposes the permanent taking over?

Capt. BULLARD. Yes.

Mr. ROWE. Are the high-powered stations the ones chiefly used for commercial business purposes?

Capt. BULLARD. That is a question which possibly would have to be a little qualified as to what you mean by commercial business. The two high-powered stations at Tuckerton and Sayville, which are daily communicating with Germany, are apparently commercial stations. They are nothing else but commercial stations. They do not even communicate with ships at sea now, and they do not do that because of our neutrality regulations, which won't allow them. So their activities are concerned with transmitting messages to Germany.

The high-powered stations on the west coast I do not believe communicate with the ships at sea. It is a different character of apparatus; it is high-powered apparatus, and you would not care to have a man doing a boy's work if he has a man's work to do.

The stations on the west coast, most of them—for instance, two or three high-powered stations—communicate with Honolulu and stations near Honolulu and not with ship stations. So to that extent they only do this commercial business. It may be in the future we will see these stations spread all through the interior of the country for communication between fixed points, in competition with the telegraph and telephone lines. When that time comes, if the control and regulation is not sufficient in this bill, then we will have to come and ask for better control, if it is going to interfere with communication with ships at sea; but if it does not interfere with communication with ships at sea, I do not think we will ever be back here again to ask for any more regulations. What will be the result then is that there will probably be so many of those they will interfere with one another very completely, and they will have to fight it out among themselves. What we are concerned in primarily, and the basic principle of this bill, as I understand, is the prevention of interference with ships at sea, so that we can get messages to ships at sea, where there are no other means of communication with them. The people on board ships at sea are helpless so far as communication goes, except by radio. The people on shore do not have to depend on wireless; they can go into a telegraph office or a telephone office, or have recourse to the mails, or send a messenger on horseback or by boat or in any other way; but the man at sea has only this one means of communication, and it is this one means of communication that we are trying in this bill to protect, so that he can get his communications back and forth without the interference that is experienced now, and which can be lessened very, very materially by having the one control.

Mr. SAUNDERS. You spoke a moment ago of a low wave. What is a low wave?

Capt. BULLARD. Well, sir, that would be getting you into a technical discussion which I do not believe you would know very much more about when I got through trying to tell you. It is simply a characteristic of those waves which you might say accompanies low power, although, of course, that is not a particular attribute of a low wave. Those waves are sent out at certain definite frequencies. One factor is the frequency of the wave length, and the other is wave length, and their product is constant. If it is a high frequency, it is a low wave length, and vice versa. A low wave length or short wave length generally applies to stations of small power.

Mr. SAUNDERS. That is what I had in mind, that a low wave and short wave length are the same thing.

Capt. BULLARD. Yes, sir.

Mr. SAUNDERS. That is the same thing as low wave?

Capt. BULLARD. Yes, sir; I would say so.

Mr. SAUNDERS. That is what I had in mind, whether they were the same thing or there was a distinction.

Capt. BULLARD. I would not say those terms are synonymous; but a low wave length generally accompanies low power, while we associate high power with long wave lengths.

Mr. SAUNDERS. There is no difficulty, I think, of having a pretty good working knowledge of the short and long wave length.

Capt. BULLARD. It is the difference of the note, what might be compared to the striking of a key away down on the bass of the piano and a key away up in the treble; the one giving a short wave length and the other a long wave length. That is where it gets its analogy.

Mr. SAUNDERS. I suppose it is pretty much like the ripples on the surface of the water, the long ripples and the short ripples.

Capt. BULLARD. Yes; there are many common analogies.

Mr. SAUNDERS. If a low wave and a short wave are the same, I think I understand pretty well what you mean.

Capt. BULLARD. The law now compels the amateur to use the short length, and when sending with wave lengths of a certain value there is not so much interference as they have when different wave lengths are being used; and where one standard wave length is being used, as required by the international convention—you might say we are bound by that convention—it produces interference as when lots of people are trying to talk and cross talk along the same line.

Mr. SAUNDERS. I imagine it is like a lot of people trying to talk in a room, all using a medium tone of voice.

Capt. BULLARD. Exactly.

Mr. SAUNDERS. And the crossing of the sound waves confuse each other.

Capt. BULLARD. Yes. A man with a very shrill voice in the room could be heard, whereas the man with a low voice, a base voice, could not be heard because of the confusion.

Mr. SAUNDERS. Those terms "short wave length" and "long wave length" are used as a working hypothesis?

Capt. BULLARD. Yes; they cover a great multitude of sins.

The CHAIRMAN. As I understand you, the wave lengths up to 600, in the provisions of the bill, are used or may be used for commercial purposes, and from 600 to 1,600 they are reserved for governmental use?

Capt. BULLARD. Yes, sir.

The CHAIRMAN. And then between 1,600 and 1,800 there seems to be an open space, and then the wave length of 1,800 is also reserved. Why is that provision made as between 600 and 1,600 and then the 1,800 meters wave length?

Capt. BULLARD. It is simply a matter of wider range. The 1,800 is required by international obligations that commercial interests can not use that wave length, except in special cases; that they must use a wave length of 600 or less; or, if they want to communicate over another station, they must use a wave length of 1,800 or above. That is why that is copied in here, because we can not disturb our international obligations. If a ship station, for instance, wants to communicate with a shore station, it is required ordinarily that a ship at sea has to communicate with the nearest shore station; and, if it does, it must communicate with a certain wave length, 600 meters; but if, for some reason or other, it does not wish to do that, but to go over the head of some other shore station, it can do that, and does do it, under the regulations if it uses a wave length of 1,800 meters, so that it won't disturb some one else using that space operating at 600 meters. That is kept in here for that reason.

Mr. SAUNDERS. A wave length of 600 meters; that don't mean oscillation of the ether 600 meters long, does it?

Capt. BULLARD. Yes; that is exactly what it means.

Mr. GREENE. Has there been any development of the receiving and sending apparatus by the Navy Department, or has that been done by private enterprise?

Capt. BULLARD. I should say both. At the Navy Department we say what we want and ask these different people to furnish it, and they come as near to it as they can. We say that is not good enough; go off about your business and try to get something better, and they do.

Mr. GREENE. That is done by private enterprise rather than by the Navy Department itself.

Capt. BULLARD. We do have our own scientists and engineers, who develop them as far as they can and enter into friendly competition with these outside concerns, and whoever gets the best that is what we take. I think that has been the policy of the Navy Department for years, especially of the radio service, only to take the best, and we require the best and nothing else wherever that can be obtained; and for the radio development, it has been the policy of the department, whenever we get a new proposition, to go to the men on the outside and ask them what they can do for us. Sometimes they start to work and reach it right away and sometimes they fall short. When they fall short we encourage them, but tell them, "You have not gone far enough; we will turn that over to another company and see what they can do"; and the first thing we know we have several of these companies and engineers competing with one another, and when they get started they take a little pride in trying to produce what we want. That has always been the case with our stations now, operated by Government men, and would possibly be more so if all the stations were under Government ownership, because then there would be the one great market for the apparatus and the Government would be the companies' and engineers' one best customer.

Mr. SAUNDERS. The longer these wave lengths are, the greater the distance to which they are supposed to penetrate. I know, theoretically, a wave is supposed to go on indefinitely.

Capt. BULLARD. I should say so; yes. As a general proposition, the art seems to find the longer the wave length the less trouble from meeting obstructions; in other words, they will go around obstructions better than the shorter wave lengths, although possibly not so efficiently.

Mr. SAUNDERS. The greater working distance they obtain?

Capt. BULLARD. Yes; as a general proposition. Of course, there are many analogies that might be used to explain that. One of the simplest is the old analogy of a spot of light which, when it strikes a corner, will make a shadow. That represents what you might call a short-wave length; the short-wave length hits an obstacle and causes a shadow on the other side. Whereas the human voice, in talking—which has a very much longer wave length than any electrical apparatus would produce—when it struck the obstruction would go around and you could hear the voice on the other side. The people outside of here can hear my voice because it goes around and bends around the corner; but the ray of light would not; but it

would make a shadow right across there. That is somewhat the same analogy as the short wave and the long wave. The long wave when it strikes the hills and mountains does not make any shadows; there is no stopping of any kind, but it bends around and, therefore, is propagated farther and holds on better and goes farther. So I should say, as a general proposition, the longer wave lengths are used for long transmission; but that is mixed up with questions of efficiency, which should not be confused with it.

The CHAIRMAN. Captain, we are very glad to have had you with us. You have given us a great deal of information.

Capt. BULLARD. I am very sorry that I can not remain to hear what the other gentlemen have to say; but I must go back to my ship to-night, as we sail within a day or two to the West Indies to join the fleet.

Commander TODD. I will introduce Lieut. S. C. Hooper, in charge of the wireless division of the Bureau of Steam Engineering, who is more up on the actual development of the apparatus as we get it to-day than any expert we have. He knows more about the subject of interference than anyone else, because he is himself an expert operator and has served as fleet radio officer of the Atlantic Fleet. He has personal knowledge of the operating conditions on the Atlantic coast, and there is no better authority on actual interference obtainable.

STATEMENT OF LIEUT. S. C. HOOPER, UNITED STATES NAVY.

The CHAIRMAN. What is your relation to this wireless service?

Lieut. HOOPER. I have charge of the construction of stations, the upkeep and maintenance of stations, and the design, development, and purchase of all radio apparatus and the equipment of ships with radio apparatus. In other words, everything except matters pertaining to the operation of the Radio Service in the Navy, questions of neutrality, and so forth, which have to do with operations and are under Commander Todd's office. As fleet radio officer during my last cruise at sea and during my period on shore in charge of the construction of stations and the purchase of apparatus, I have had an excellent opportunity to study the whole radio situation as it exists, especially the practical interference problems, as I have listened in and operated in all parts of the world—naturally, as we go from one ocean to the other—and also the actual apparatus and development problem, through my connection with the Bureau of Steam Engineering in the purchase of apparatus; and I would like to say that any decision which is made in connection with this proposed bill must be based not only on the theoretical possibilities, which in themselves are not sufficient to permit two separate organizations occupying the same field, due to interference troubles, but the study of the operation requirements—the class of men which must be employed, the limited funds which must always be available, either of the Government or any commercial concern, to conduct any business, and the various peculiar conditions met with by the ships operating in different zones, has caused me to decide, as much as I may or may not be concerned, between the policy of Government ownership and private control, that a monopoly is necessary in the case of radio communication.

There have been marked increases in efficiency in high-powered stations in the last few years and a few changes in efficiency in commercial stations. The improvements in apparatus have not kept pace, however, with the use and scope and the requirements of the art, nor will they ever to the extent that rival concerns can divide up the air as efficiently as one concern.

We have many plans for the use of the radio, both for the Government to assist commerce and navigation, for military purposes, and for other important purposes, which must be withheld and delayed, due to the fact that science is not able to devise a means whereby these uses may be effective without confusion, interference, and the resulting inefficiency. In other words, as fast as the art develops we find so many new uses which are absolutely necessary for the handling of messages between ships at sea and between the shore and the ships, and to assist in navigation, and all that, that science can not keep up with our demands.

The first task is now to clear the air so that ordinary man may use it to the best advantage. To do this some one concern on each coast must have a monopoly. If it were not for the military requirements which embarrass countries in these days and threaten to embarrass them throughout our generation, it might be said to be immaterial whether the Government or a private commercial concern exercised this monopoly; but for military reasons it is necessary that the Navy own and operate the coastal stations, to be always ready, instantaneously, and for the fact that the Radio Service will soon play an important part in assisting navigators to pilot safely vessels, especially in foggy and thick weather, the Department of Commerce must maintain a strong interest in the matter. So it is better, then, that the Government exercise this monopoly, if a monopoly is necessary.

Experts will state that the increased efficiency in the art will render a monopoly unnecessary. I am convinced that this is not true; that as improvement continues, the increased necessity for improvements in the way of greater scope will make this monopoly all the more necessary. In my capacity in charge of equipping ship and shore stations, the purchase of apparatus for naval stations and for naval ships, and for the United States Navy in general, I am sure that the Navy is the most extensive purchaser of radio apparatus in the world; that is, our Navy. I have become thoroughly familiar with the prospects for improvements, with the hopes of the inventors, and feel qualified to state positively that with Government ownership of the small coastal stations the art will not suffer in any way, but the opposite result will be achieved—it will receive a greater impetus. Just as much and more apparatus will be purchased and from just as many companies. The Navy practically keeps these companies alive to-day by its purchases. Every prominent radio manufacturer in the United States is working hard for the Navy. During the last two months alone the Navy Department has placed contracts for roughly \$400,000 worth of radio apparatus. The department is alert for the latest apparatus, and every reliable concern is constantly submitting new samples for tests. Undoubtedly, many feel we are slow in accepting some minor new ideas, and I do not blame them, but we must consider that every change made in a standard is a further complication to render operation difficult by the operators at sea, and constant

changes greatly handicap efficiency for this reason. What we must always consider is the question of whether the slight increase of efficiency is worth the handicap to the men who operate the apparatus. The operation must be considered always first, and not the slight increased result; not what the apparatus might do with the more skillful man than is possible under any conditions to be obtained for such work.

The attempt will be made in these hearings to lead the committee astray from the main issue, by discussing disadvantages to the art. The art is the apparatus, and the Government will no more reduce the interest in the apparatus by taking over its use than it does at present.

With these few words about the development of the art, I will discuss the question of interference, with which I am quite familiar. I have listened in on both coasts, a great deal in Europe, and the Mediterranean, even in war time, and I have come to the belief that the interference question is absolutely unsolvable except by Government ownership of coast stations. It can always be proved, apparently, by the scientists that we should not have any interference, but it can not be done. In the operation there is interference all the time between the ships, between ship and shore stations, and between rival shore stations, and there always will be unless the Government takes over the coastal stations. I have heard it stated, even recently, that there is no interference between the Navy and shore stations, and yet you can go into any locality at any time and see that there is the most serious interference. Within the last two months I was in New Orleans. I went into our naval station at the New Orleans Navy Yard and called up some vessel, and immediately the two commercial stations in New Orleans called the New Orleans naval station and told him to keep quiet, that they were sending or receiving from ships. There was an example where only one station can work at a time, and yet our wave lengths are very widely different from theirs. We were on quite a long wave length, and the commercial station there was working with a ship, and the ship's wave length is the short-wave length; and yet the minute the naval station started to send, the commercial station could not receive the ship at all, and he told me that I must keep quiet. That is what happens all along the coast. You have two or three stations in a restricted area, and one has to wait until the other gets through. It would be much more efficient if you had just the one station there handling all the work, and there would not be any argument about it at any time.

I went to Key West and while I was attempting to work with one of our ships from the Key West naval radio station, one of the merchant ships passing close by Key West started to call the Marconi station at Tampa, Fla., which is several hundred miles away from Key West, and I was unable to receive anything from the ship I was attempting to work with, several hundred miles away, because the ship close by would insist on calling a station some distance away and trying to work with it, knowingly interfering, in spite of the international regulations. The ship close by should really have given her message to me as being the nearest coastal station; but the ships have operators who are loyal to the concerns for which they work. For example, if they are working for the Marconi company, they won't give their message to the nearest coastal station at all times if

by any possibility they can work with a Marconi station. In this case the passing ship should have given her message to Key West. They were within 10 miles of Key West, but they did not do that, the operator insisting on calling a station 300 miles away and making so much noise I could not work with any ship, even the one which should have logically worked with me. If they had given the message to me at Key West, they could have done it on low power and it would have made no trouble.

Those conditions exist at many of the coastal stations and always will exist as long as you have two companies in the field. The companies have a hold on the men who operate the sets, men in their employ, and these operators try to give their messages to their own companies' stations, no matter where they are, even though it interferes with the naval station or the shore station of some other company. There always will be that feeling of loyalty between the operators of a company and that company's stations.

There are a good many troubles also because the commercial operators won't recognize any one coastal station as the controlling station. The commercial operators think that the commercial stations only ought to control and they won't pay any attention sometimes to the naval station when they are told to keep quiet; and the naval operator will think that the naval station ought to control the situation and won't pay any attention to the commercial station. When the question of interference has to be settled immediately on account of a distress call, both sides try to take charge and refuse to give way to the other. That happens right along. I have heard a ship make an S O S, and then a disgraceful condition would follow where several shore stations attempted to communicate with the ship, and several ships and the nearest naval station and the nearest commercial station would all try to take control of the situation and nobody would obey orders from anywhere. Now, there has got to be one company running the whole business; it has got to be the Navy or some commercial company, and then the operators will respect the rules of that one company. The Navy is better qualified to do it because the Navy operators are disciplined; they understand that they have to carry out orders; the military service always does have more disciplined employees. They are trained to discipline, that is their first idea, and discipline in the air is absolutely essential. I do not complain that the commercial operators do not try to respect the rules or that they do not have discipline in their companies; but, naturally, they can not be expected to have the discipline we have in the military service. That is what we are; we represent discipline, and the operators have that bred in them.

You can go in many places along the coasts and find the most serious conditions of interference. Here at Norfolk there is a naval station and a commercial station within 10 or 15 miles of each other, and they are both trying to work with ships at sea, and there is all sorts of interference there. We have had to take turns working, to make way for each other, and in taking turns there is bound to be a lot of lost motion and delays and serious inconvenience, and unimportant messages are given the right of way over important messages, and important messages are delayed because there is no one station in control.

Mr. GREENE. Let me ask you a question right here. Of course, while I realize that in matters of neutrality, or anything of that kind, or anything that affects the country's interest, the Navy ought to have precedence; still, if you are going to destroy the business operations by an arbitrary power, why is not that going to be disadvantageous? Could there not be some attention given to the business interests? If the Navy gets possession, are they going to take possession and deny the business interests any opportunity?

Lieut. HOOPER. No, sir. The idea is to handle all the business, and when a crisis comes, like a ship in distress, or something of great emergency, the matter can only receive proper consideration from one head office.

Mr. GREENE. Those things do not occur every day?

Lieut. HOOPER. No, sir.

Mr. GREENE. They only occur incidentally, once in a while?

Lieut. HOOPER. Yes, sir; but when they do occur they are of the greatest importance.

Mr. GREENE. Oh, I agree to that.

Lieut. HOOPER. It is the same way at Boston. I have taken the key at Boston and called up a vessel to send a message to it and been told by the station there to keep quiet, that they were receiving from some station.

Mr. GREENE. Is there not some chatting going on between the naval stations sometimes outside of legitimate business?

Lieut. HOOPER. No, sir; we have the most stringent rules about that; both the Navy and commercial companies have very stringent rules about that. It used to be, a few years ago, when there was chatting going on all the time; but that was before the present law went into effect, and now the matter is pretty well under control through the combined efforts of both the commercial stations and the Navy. The chatting is fairly well eliminated, although it is carried on still in some places; not in the Navy, I do not think, as much as in the commercial stations; but there is still some illegal carrying on of conversations.

Mr. GREENE. Of course the men in private business, the ordinary citizens, do not look upon the men in the Army or Navy as being supreme; whereas the men in the Army and Navy think they are; and it is natural, because they are trained to it. I realize that. But, too, the individual claims some rights as an individual.

Lieut. HOOPER. Yes, sir. The idea is merely to have the thing in one command, where a proper decision can be made in case of emergency, and that is not the case now. If you have all naval stations and all under one set of rules and all governed from one head office, things will be regulated so that in an emergency they will know who is to take control and the operators will respect that control. If you have two sets of stations, one of the commercial concerns and the other of the Navy, each will have its own rules, and in time of emergency each will try to take control, naturally. You can not have anything else, no matter what rules will be made. The matter is very unsatisfactory now.

On Cape Cod we have a station. I visited there some time back and about 9 or 10 in the evening the operator took his phones off and said he could not hear anything because rival stations near by

were sending out their "press." He was unable to operate, unable to listen on the ordinary ship's wave lengths, because "press" was being sent out by this commercial station on a considerably longer wave length. Scientists will explain to you that that can all be tuned out; that there should be no interference there. It can be tuned out by the scientists by a set of delicate instruments which we can not take aboard ship, and we can not hire civilians to use such apparatus on the ships. It would be absolutely impracticable. All we can do is to try to hire good men, and we employ good operators.

The CHAIRMAN. You could not put a scientist on each ship?

Lieut. HOOPER. We could not put a scientist on each ship, and if we could, they would not be of any use anyway, because they would not be any good except as scientists.

The CHAIRMAN. And they would not be of any use, anyway, as operators?

Lieut. HOOPER. No, sir.

(Thereupon, at 12.45 o'clock p. m., the committee adjourned until to-morrow, Tuesday, January 16, 1917, at 10 o'clock a. m.)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 16, 1917.

The committee reconvened at 10 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. You may continue your testimony now, Lieutenant.

STATEMENT OF LIEUT. S. C. HOOPER, U. S. NAVY—Continued.

Lieut. HOOPER. When I left off we were talking about the interference between the different stations and ships, as it exists under the present conditions. I was giving different examples of interference to illustrate the condition. The last was Cape Cod, where the Navy has a radio station at Highland Lights, about 15 or 20 miles from the Marconi station on Cape Cod, at South Wellfleet. I was in the naval station one evening when the operator on watch took off his phones, with which he was receiving, and I asked him why he had done that. He said he could not receive at the same time the Marconi station was sending their "press." I listened in myself and found it was impossible to receive the ordinary ships on the ship's wave length, even though there was a great difference between the wave length used by the ships and that used by the Marconi station which was sending out "press." That illustrates the difficulty that exists when one station is attempting to receive faint signals at the same time that another station, even though with a widely different wave length, is sending 15 or 20 miles away, on high power.

Mr. BURKE. How far apart were those stations?

Lieut. HOOPER. Somewhere between 10 and 20 miles, I should say. I am not familiar with the exact distance.

We have the same thing in our Fire Island station, New York, which I should say is about 10 miles from the high-power station at Say-

ville, belonging to German interests. When Sayville is sending, Fire Island has great difficulty in receiving from ships on short wave lengths, although Sayville may be working on a much higher wave length and with very efficient apparatus, due to the fact we can not get away from the high-power stations on a short wave length. We could probably tune Sayville out ordinarily at Fire Island, if we had a very skillful scientist there to do it; but the poor operators can not do it. We have just as good operators as anybody; in fact, a good deal better than any other company in this country. Our apparatus is far superior to any commercial concern. I have seen the commercial stations, most of them, and have seen most Navy stations, and I should say on the average the Navy apparatus was at least twice or maybe four times as good as the commercial apparatus for ordinary ship and ordinary commercial stations. The expense we go to, in the Navy, to build good stations—and we get all of the latest and finest apparatus—is far greater than is possible for the commercial people. Of course, there are the few exceptions of the high-powered stations, where the commercial companies go to the greatest expense to equip their stations with the finest apparatus; but the ordinary coastal stations of the Navy are far superior; and for ships there is no comparison at all. The Navy apparatus on ships is far, far superior to what is found on merchant ships.

There are two commercial stations operating between Philadelphia and New York which have always been the cause of contention—the Wanamaker stores in Philadelphia and New York. They exchange messages all day long. They are commercial stations, and cause a great deal of interference, which is a bad thing and should not be allowed. It is contended they use wave lengths which should not interfere with ship-to-shore work, but practically this is not true, as I have had the experience, as radio officer of the Atlantic Fleet and actually operating between different ships of the fleet, have had an opportunity of seeing what the actual conditions were; and I had many occasions to be interfered with by the Wanamaker stores.

The CHAIRMAN. What is the occasion for them to use this apparatus—just advertising purposes?

Lieut. HOOPER. Either for advertising purposes, or else it is cheaper for them to exchange messages by radio than it is by telegraph. They have so many messages to exchange between those two stores, about shipments back and forth between New York and Philadelphia, that they use this direct means of communication instead of using the ordinary telegraph.

The CHAIRMAN. Is it less expensive for them to maintain their stations in New York and Philadelphia and have their own private operators than it would be to use the commercial stations?

Lieut. HOOPER. I would not be able to state that, sir; but I think it is about an even break. I think they like the idea of having direct radio communication between their stores.

Mr. HADLEY. Do you know how the cost of communication in this way compares with the cost of communication in the ordinary commercial way? I realize that is rather collateral to this inquiry.

The CHAIRMAN. Yes. What is the reason for their maintaining that service when they are aware it interferes with ship-to-shore service?

Lieut. HOOPER. I think, sir, they do it more because they like the idea. They are a very rich company, and, whether it costs more or less, they would probably continue it. I am not able to state what the relative costs would be.

Mr. ROWE. You said there was still another commercial company, besides the Wanamaker, between Philadelphia and New York; who is that?

Lieut. HOOPER. I do not understand that I mentioned any other commercial company.

Mr. ROWE. I thought you said there were two companies between New York and Philadelphia that interfered with the ship-to-shore communication.

Lieut. HOOPER. No, sir. The Navy used to work between Philadelphia and New York, and we found we were interfering, too, so we stopped our work between these points; but this other work continues.

Mr. BURKE. Let me inquire right there: If this bill becomes a law, is it contemplated that the Government shall take over that wireless system between the Wanamaker stores in Philadelphia and in New York?

Lieut. HOOPER. I think Capt. Todd will have to answer that question.

These conditions of interference exist also on the west coast. San Francisco is a great center of interference. They have a high-powered station at Bolinas belonging to the Marconi Co. which is equipped with a very high power radio transmitting set for operating with Hawaii. When this set is sending, although on a very long wave length, its interference is such that for 50 miles around all the stations in the vicinity are put out of business or their efficiency in receiving greatly reduced. Our station on the Farallon Islands, off San Francisco, I imagine, is 30 or 40 miles from Bolinas. It complains frequently of difficulty in receiving the faint sounds from the ships—and the Farallon station exists for the benefit of shipping—because of this interference from Bolinas. The wave length of Bolinas is something like 6,000 meters, and Farallon is down to something like six or eight hundred meters. There is a very wide difference in wave lengths, and yet, in fact, the interference from Bolinas is very serious, and the ships trying to send and operate with Farallon station can not get their messages through at times. There are also other stations around San Francisco which cause interference. It is a very serious condition there, and it is an example of one of the many places where this condition has grown up and is getting worse. There will be no end to it if it is allowed to go on. It is nothing now as compared with what it will be 20 or 50 years from now. Then nobody will be able to get anything through if the stations are allowed to be erected, as they are now, without restriction.

The radio art is in its infancy now and there are a few big stations, but if they are allowed to go on increasing in number nobody will be able to work at all. It is something you can not see, and therefore you do not realize the conditions that exist. If you saw two trains trying to pass each other on the same track you would not permit it; it would be stopped right away. This is a similar

condition; but you do not see it and therefore the seriousness of it does not dawn on you.

In Hawaii is a condition far more serious. The Federal Telegraph Co. has a high-power station there and the Marconi Co. has a high-power station there, and the Navy is building a high-power station also—all on one island. We expect to have very great interference on this little island when we get those three stations going. It will be a very serious condition for all; and it seems too bad that either the Navy or any commercial company should be placed in such a position, that they should be allowed to spend a million dollars on a station and then perhaps not be able to operate it effectively because of interference. We are equipped with apparatus which is the best there is, in endeavoring to operate our stations selectively, so that this interference can be cut out or reduced, and we have as good operators as any; and yet, in practical operation, the present law is entirely unsatisfactory. I imagine that the opponents of this bill will say that we have lots of defects in our operation and will claim that our operators are not as good as commercial operators; but I am able to state that the Navy operators are as good as commercial operators, and, in many cases, better. We have some poor operators and they have some poor operators, and in every matter there is criticism on both sides; but, on the whole, I think ours are better than the commercial operators. I do not mean to say that their operators are not good, but we give our men certain advantages which I do not think the commercial operators have, and we get somewhat better results.

I have in mind a case where, as a courtesy, we put one of our radio sets on one of the colliers operating on the Atlantic coast, because this collier was unable to obtain a commercial set before sailing. The company that owned the steamer claimed that the apparatus was not any good. It developed that the commercial company that supplied the operator to this ship had supplied a man who was not good enough to work the apparatus that we use; ours is so much better, and necessarily more complicated, due to its increased selectivity and other features. This operator could not make the best out of it; and he stated he only got \$20 a month, and it was not worth his time to learn all these things. We can require our men to learn all of these things.

I only give that as an example to show that the commercial operators are not perfect any more than anybody else. We have men who do not carry out the regulations at all times, and so have the commercial people. I have no doubt we could spend all day giving examples of each other's faults; but that would be entirely beside the question. We are both trying to do the best we can.

The CHAIRMAN. We will suspend now and the committee will go into executive session.

(At the conclusion of the executive session the committee adjourned until to-morrow, Wednesday, January 17, 1917, at 10 o'clock a. m.)

COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
HOUSE OF REPRESENTATIVES,
Wednesday, January 17, 1917.

The committee reconvened at 10 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. You may proceed, Commander Todd.

Commander TODD. Mr. Chairman, Lieut. Commander Hooper has been ordered away from the city and we will not be able to have him here again. I spent some time with him yesterday afternoon and found out what part of his very important statement had not been given, and I am prepared to cover anything that has not been covered by him or will not be covered by two gentlemen that I have here this morning. The principal point is the question of the Government's monopoly and ownership of stations retarding the art.

The CHAIRMAN. Did Lieut. Hooper leave a memorandum which he wanted to have put in the record?

Commander TODD. No, sir. We talked it over and I took notes which I have here.

The CHAIRMAN. Very well, proceed.

Mr. GREENE. With whom was that conversation?

Commander TODD. The officer you had testifying yesterday. To show the Navy Department's anxiety to get out of the art the best there is in it, we have had in our employ since 1908 a scientist of high order and of high standing in the scientific world, who has done nothing but work on the higher aspects of radiotelegraphy for the benefit of the Navy Department, and, therefore, for the Government, during all those years since 1908—Dr. Austin, sir.

**STATEMENT OF DR. L. W. AUSTIN, EXPERT IN RADIOTELEGRAPHY
FOR THE NAVY DEPARTMENT.**

The CHAIRMAN. Give the committee your name, please.

Dr. AUSTIN. L. W. Austin.

The CHAIRMAN. What is your connection with the Navy Department?

Dr. AUSTIN. I am the expert in radiotelegraphy for the Navy Department.

The CHAIRMAN. You are a civilian?

Dr. AUSTIN. I am a civilian; yes, sir.

The CHAIRMAN. What were your former connections before you became an expert for the Navy Department?

Dr. AUSTIN. I was working for a number of years as a guest at the Bureau of Standards. Before that—do you want me to go back of that?

The CHAIRMAN. Yes; so that we will know something about it.

Dr. AUSTIN. I was at one time assistant professor of physics at the University of Wisconsin, and afterwards I was abroad for some study and work. Then I was at the Bureau of Standards as a guest, and during that time I did some special work for the National Electric Signaling Co. That was the beginning of my work in wireless, in 1905. Then, since 1908, I have been in my present position in the Navy Department.

The CHAIRMAN. Proceed.

Dr. AUSTIN. Since I have been connected with wireless telegraphy, of course I have watched the progress of the art with great interest, and the points which I wish to bring out this morning are regarding the nature of the progress which has taken place since the early days. The greater part of the advance which has taken place since, we will say, 1908, has been along the line of the high-power stations, which are stations using high-power machines. Small apparatus, such as is used in the ordinary wireless station, has not changed to any great extent. The very best apparatus which was used in 1908 is practically as good as that used to-day in the corresponding stations, as far as sharpness of tuning and freedom from interference is concerned, which I understand are the chief points of interest in regard to the Government's control of the stations. Of course at that time the average of the apparatus which was being used in the various stations was not as good as it is to-day. The general average has been raised. But the best that was known at that time was practically as good as that we have now. This improvement in the general average of apparatus and general freedom from interference has been most marked since 1912, and I believe it is more due to Government regulation and the requirements which the Government has made with regard to the apparatus and methods of working, than to general progress of invention.

The CHAIRMAN. That is since the enactment of the original radio law?

Dr. AUSTIN. I beg your pardon?

The CHAIRMAN. I say that is since the original radio law was enacted, of which this is an amendment.

Dr. AUSTIN. Yes. Of course it was claimed at that time that Government control would interfere with the progress of the art.

The CHAIRMAN. Oh, yes; these people were here and fought the bill at every point, claiming that it would destroy the art and its development, and in every other way.

Dr. AUSTIN. Yes. They made the claim that if they were left to themselves they would solve this problem of interference; but of course we all know it has not been solved; and that it is only by regulation and control by one central body that successful working can be carried on. And a more complete control would, in my opinion, give even better conditions of working than those which we have to-day.

The Government itself has done a great deal for the advancement of the art in a technical sense, as well as in the way of control. At the Bureau of Standards three laboratories have been established by the Departments of Commerce, War, and Navy, all of which are housed at the Bureau of Standards. The Navy and War laboratories, of course, are there by the courtesy of the bureau, while the Commerce laboratory belongs there. And from these laboratories a good many devices have come out which have proven useful in the art and special progress has been made along the line of measurements—the measurements which are required for high frequency work. Prof. Rosa, who is Assistant Director of the Bureau of Standards, I know holds that a more complete Government control will be to the advantage of the art; will be a help rather than a detriment. I think I may also say that the Government radio stations,

high power, the ordinary coastal type, and the ship stations, are all of them of a higher average than those of any single private company.

I think that is all I have to say.

The CHAIRMAN. You say a higher average; where does the Navy get its supplies and equipment?

Dr. AUSTIN. It buys from the private companies.

The CHAIRMAN. It selects the best?

Dr. AUSTIN. It selects the best; and it makes its own specifications.

The CHAIRMAN. And if the Government should gain the control that it would have under this bill should it be enacted into law, it would not limit the activities of the manufacturers of those appliances, would it; but it would create a stimulus to the further development of the art, because the demand would not be diminished?

Dr. AUSTIN. I do not think that it would. I think the conditions would remain practically the same.

Mr. HARDY. Except in one respect. Should there be no restraint on private companies there might be many useless installations of wireless which would all call for plants?

Dr. AUSTIN. Yes.

Mr. HARDY. Whereas with Government ownership and control there might be fewer stations and therefore a less amount of manufacture of those articles?

Dr. AUSTIN. Yes; that is possible.

The CHAIRMAN. There are duplications in a certain area now, but if the art were logically developed there would be more stations, wouldn't there?

Dr. AUSTIN. Oh, there would undoubtedly be a constant growth, so that in a few years from now there would be a good many more stations than we now have, even though we should do away with a good many which are considered useless.

The CHAIRMAN. The distribution would be more reasonable and more in harmony with the proper development of the art; the commercial as well as the military and naval requirements of those stations?

Dr. AUSTIN. Yes.

The CHAIRMAN. Are there any further questions from this gentleman? If not, who will you have heard next?

Commander TODD. Mr. George H. Clark, sir. While he does not call himself a scientist, he is a technical man of the highest grade—a practical man—who has been connected with the subject of wireless telegraphy since the very earliest stages, and especially with this subject of noninterference and tuning. He knows the first successful attempts with that and has a very intimate knowledge of naval and commercial apparatus.

**STATEMENT OF MR. GEORGE H. CLARK, EXPERT AID FOR THE
BUREAU OF STEAM ENGINEERING, NAVY DEPARTMENT.**

The CHAIRMAN. Are you connected with the Navy Department?

Mr. CLARK. I am a civilian employee of the Navy Department and expert aid for the Bureau of Steam Engineering of that department.

The CHAIRMAN. How long have you been in that employ?

Mr. CLARK. I have been with the Navy Department at Washington since 1908.

The CHAIRMAN. And prior to that, were you a student of this art?

Mr. CLARK. After my graduation from college, in 1903, I was in the employ of the Stone Telephone & Telegraph Co., of Boston, as one of the engineers, and studied with that company until I went with the Navy Department.

The CHAIRMAN. Of what college are you a graduate?

Mr. CLARK. The Massachusetts Institute of Technology, of Boston.

The CHAIRMAN. Proceed.

Mr. CLARK. Since I have been with the Navy Department at Washington I have been assisting, as technical assistant, to the Bureau of Steam Engineering, with regard to the specifications under which we purchase apparatus, the purchase and testing of the apparatus from the commercial companies; and for the last few years in connection with the research work which has been done within the Navy itself. And I have been very fortunate to have thereby gained complete information on the technical side of the Government activities, both as to purchase and design within the Navy. As far as I have been able to observe, any question of the Government stifling the development is absolutely the opposite of the truth; because the policy which I have noted is that the Government has always wished to have mutual cooperation between the companies, which is, apparently, quite different from the line which has been followed by the companies as against the Government. The companies are better fitted for research work on details of apparatus, although the Government also has entered on this field and has made certain developments and certain inventions in its own lines. But, in general, the policy of the Government has been to improve apparatus developed by the commercial companies and to revise it so as to make it more fully applicable to military purposes; and in almost every case it has required a great deal of revision in order to make it fit for the more rigid uses which such apparatus gets on board ships and at the shore stations of the Navy. In making the apparatus more rigid—more fool proof, is the phrase we usually use—I think the Government has set a standard for the commercial companies, and I have noticed in late years they have been following that standard very largely, and it has improved their equipment and made their apparatus more standard throughout.

On the question, however, as to the broad features of radio-telegraphy, as to what systems should be used, and what type of apparatus should be discarded, and large questions of that character, I think that the Government has always been in the lead. A commercial company has to have a system working for some time, at least until the apparatus pays for itself. It could not discard its apparatus every time anything new came out in the art. On the other hand, the Government has discarded apparatus as soon as anything even slightly better is found in order to keep ahead of foreign powers. And this, positively, has been the point of view that the Navy Department has followed—at least as much as I know of it.

The CHAIRMAN. Do you find that is the policy of foreign Governments—whenever there is any improvement—to discard the old apparatus and install the new?

Mr. CLARK. I have had no opportunity to observe that to any extent. The slight observation I have had shows we are ahead of some of the foreign Governments in that point of view; but my experience has been limited as to the practice of foreign Governments. I know we are ahead of some Governments.

We can take several examples of what the Navy has done in keeping ahead of the art. We had at one time the highest-powered station in the world at Arlington. We had a \$100,000 plant there which worked excellently—a spark set. It was found, when one of the commercial companies brought some apparatus to us, that there was a better apparatus for high-power work—the so-called arc apparatus. The Government thereupon sent one of its cruisers on a trip across the Atlantic to determine definitely, from a scientific point of view, whether the arc set was better than the spark set, and also from a practical point of view whether it was better or not; that is, whether the operators could handle it more expeditiously, whether it could work better in storms, and from all points of view. I was very fortunate to be on the ship at that time. We gained a great deal of information both practical and technical. That trip, of course, cost a great deal of money. No private concern could have afforded to detail a large ship expressly for such a purpose.

The ship was under the complete control of the Arlington Station and made the voyage in accordance with the orders from the main station, so that the test was a scientific test, and that was the whole object of the trip.

Having determined from that trip that the arc set was best suited for high-power stations, all the high-power stations which we now have are of the arc type, and we have discarded, except for breakdown service, the spark set at Arlington, although by no means obsolete, and put the arc set in. The results have more than justified that change and the taking out of the spark sets, in that the chain of high-power stations are now working and working exceedingly well. The high-power stations of other companies, with the exception of one company which supplies this type of apparatus, the arc type, still stick to the spark type. At the present time we have a high-power station at San Diego, which is just going into commission and which has been under test for a few days and has been shown to be an exceedingly powerful station; in fact, it far exceeds our specifications and even our hopes in that respect.

In regard to other developments which the Navy has fostered, I may speak about the oscillating audion for the receiving of signals. It is a new method of receiving signals which supplants the older method, although the older method is still in use to some extent. This new method was first taken up and helped along by the Navy Department. As soon as that method was brought to our attention it was tested, under control of Dr. Austin, of the Bureau of Standards, and found to be a very excellent method of receiving signals and much more effective than the former method.

The CHAIRMAN. What was the former method?

Mr. CLARK. The former method made use, in general, of a crystal detector by placing two plain crystals up against each other. This oscillating audion consists of a bulb, an electric light, practically, with a number of other features inside the globe, and special control

features. It was invented by a commercial company and developed by it and then brought to our attention. Since it was brought to our attention it has been adopted at a large number of places, and we have bought hundreds and hundreds of outfits. It costs very much more than the previous outfits. The detector itself costs somewhere around \$200, and each electric-light bulb renewal costs somewhere around \$10, whereas the entire crystal detector which it has replaced costs somewhere around \$15. Although the cost is very much greater, on the other hand the advantages are very much greater.

The CHAIRMAN. What is the advantage of this device?

Mr. CLARK. By the use of this device we have been able to cover very much greater distances with the same power of transmitter. The chief advantage is it is much more sensitive. Another advantage is it enables messages to be caught during a severe storm, severe interference, which with other types of detector would prevent the reception of messages. It has made our service much more efficient.

A similar development has been made in the spark-set apparatus, with regard to the adoption of the mica transmitting condenser. The former condenser used in our spark sets consisted of a glass jar coated on the inside and on the outside with copper, and of course it was very breakable. A firm brought to the Navy Department's attention the advantages of a type of condenser which they had developed, which was sealed in a metal container that could not be broken. It was very much smaller than the previous type and had slight electrical advantages. We gave this condenser a very thorough test and decided it was desirable to standardize on it, and we have done so and placed a large order. The cost of that condenser is very much greater than the previous one, but it has so very marked advantages we feel justified in making the change. And I note now the commercial companies are beginning to adopt condensers of the same type, in that the apparatus they are now supplying to the Navy Department has this condenser in it.

Mr. HARDY. That would be natural anyhow, if they knew you required it?

Mr. CLARK. They can supply any type they wish.

Mr. HARDY. But they know the Navy Department does not want any except that particular kind.

Mr. CLARK. We do not specify any particular kind. Of course, as you say, they realize it would be better to supply the apparatus we prefer to have.

The CHAIRMAN. You mean that under your contract they could furnish the other style?

Mr. CLARK. Yes; under the contract they could furnish either style.

Mr. HARDY. But you would hardly buy one which you considered defective?

Mr. CLARK. We would not care to.

Mr. HARDY. Consequently they want to furnish you with the one they know you want, which is this later type?

Mr. CLARK. Yes; I suppose that is the case. I do not know whether this condenser has been adopted by the commercial stations or not. It has not been on the market sufficiently long to be adopted, I think.

When the question came up of adopting the arc set for high-power stations, the Navy Department realized that it was taking a step in advance and of course there were certain elements of doubt about it. But the experiments carried on on the *Salem* seemed to indicate we were making a good resolve, and experience has shown that we did so.

The next step, which is coming in the very near future, is in making use of a similar apparatus in the very low-power stations, for the small sets for ships, aeroplanes, and so forth.

The peculiar features of the arc set as against the spark set have shown up very well in high-power work and we have now practically decided that the same type of oscillations, generated in a different way, will be used for low-power work. This has not been adopted by commercial companies as yet. We have bought a number of pieces of apparatus of that type for low-power work, aeroplane work, and small-set work, and we are fostering that to the utmost extent because we feel continuous oscillations, as they are called, will be much better for low-power work. That is a step we are taking at the present time which again we think will be a step in the advance of the art. In a recent test at the Washington Navy Yard we found that we could cover twice the distance with this new set than with the former, and hence we are slowly but surely tending toward the use of such apparatus.

Mr. HARDY. What is the weight of the new type of apparatus?

Mr. CLARK. The weight of the sets I tested was about 150 pounds in each case. The spark set, of which we have a great number in the service now, was of that weight, and this new type was also of the same weight. It was intended to be used in field work, where a maximum distance for a minimum weight is the requirement we are trying to fulfill, as the sets must be carried.

Mr. HARDY. That is for use on the aeroplanes?

Mr. CLARK. This particular set was for use in field work, for companies to communicate with each other in the field. The same type of apparatus has been purchased for use on aeroplanes, where the question of weight is again of vital importance.

In regard to the research work which the Navy is carrying on to supplement and assist commercial development, I may mention that we have now 14 civilian engineers, practically in all of the large navy yards, and with all the manufacturing facilities of each yard back of each engineer. Each yard is assigned a certain specialty in radio apparatus, which in general is the specialty of the expert assigned to that yard. Development work, and to a slight extent manufacturing work, is carried on. The Washington yard, with which I was connected for some time has developed receivers that in every case compare favorably with commercial receivers which we purchase from the outside. On last year's order, the navy receiver, the type developed at the Washington Navy Yard, was better than any commercial receiver. On this year's order one commercial receiver beat the Navy receiver. And that is the tendency, to seesaw from one to the other. Every development the Navy has made in receivers has been given to the commercial companies to the fullest extent, and the greatest cooperation has been allowed. And I think it has been mutual. We have received just

as many, if not more, suggestions from the commercial people. And I think, as a result, it has tended to a standard form of receiver. The chief advance has been in the method of control, so that the operator going from one station to another knows just how to operate the receiver; the new set looks like the one he worked with at the last station. And that is a great point that has been brought out, because the method of operation is the same, the operator feels at once he is familiar with the device and he goes to work at once without any false moves; and in so standardizing the receiving apparatus of the sets, we have decreased greatly the difficulties of receiving. All the commercial companies now supplying sets to the department, make use of our Navy control method, and from the outside of the receiver it would be difficult to tell just who made the set.

Another matter of mutual cooperation is that in our method of making the specifications under which we buy our apparatus. Before drawing up the requirements we send to all of our civilian assistants in the Navy and ask them to comment on their specialties; we send to all the officers in charge of ship and shore stations that use that apparatus and ask them what defects they have found in the apparatus they have been using in the past. Then we send to all the commercial companies who are manufacturing companies and we get them to submit their ideas and ask them to comment on our specifications. We also ask the electrical manufacturing companies for comment; the General Electric, the Westinghouse, and the Cutler-Hammer may be mentioned. They recently sent representatives to Washington who spent several days going over the specifications for motors and generators and we received a great deal of valuable information from their exhaustive experience in the manufacturing line. Then, after all this information is gained, we call for a set which is the product of the highest practical engineering talent, and as a result our sets are of the very best. That is absolutely the result of cooperation, part of which is due to the Navy and the greater part of which is due to the various commercial companies.

In regard to new developments in radio engineering, I do not quite see where there is any question of the Government stifling development. In the eight years I have been in Washington we have been constantly conferring with all the radio companies and all radio engineers on new developments. Whenever they get a good idea, even though it is merely on paper, I have noticed they always come to Washington and bring it to our attention. And in every case, if it shows a possibility of working, we ask them to make a test and show us the result of the test; and we offer them, as we almost always do, the use of a navy yard to set the apparatus up and demonstrate it. We are carrying on every day tests of something of that kind and reports are coming to us daily. As a result of that we have obtained a number of very valuable inventions, particularly in the last two or three years, and we have adopted them and are installing them as fast as they are brought to our attention and are ready to be used in the work.

Another feature to which I may point with pride is the fact that every engineer whom I know feels he can trust the Government

to keep the details of his invention secret. I have not ever yet heard any complaint of any leak from the Navy Department in that respect. I may call attention to one special case, that of the Western Electric Co., which carried on new experiments in wireless telephony over here at Arlington for over a year before it was known on the outside. We were in constant touch with these experiments at the time, and no question whatever was raised of anyone finding out what was going on. On the other hand, any of our developments, any development of apparatus we should make in the navy yards, are not kept secret in any respect. We allow all the companies, on equal terms, to see what apparatus we have made and what the designs are, and we ask for the fullest criticism.

With regard to the wave-length regulations, I know the Navy was the first to fully make use of the range of wave lengths which are available in radiotelegraphy. We long ago recognized the necessity of being able to make use of the different wave lengths; and for two years we asked the companies to design apparatus which would change quickly from one wave length to another. It is not a simple thing, like turning a switch; it requires three or four or five different operations, and, if done individually, each operation by itself, would take some minutes to make the change. We wished apparatus which would enable us to change from one wave length to another immediately, but no company brought forth the apparatus and so it was developed and manufactured by the Navy Department itself. That apparatus is now in use in every naval station and in a large number of commercial stations; and by this means we are enabled to call a station on a certain fixed wave length, that every station knows—the calling wave—and then, having received the answer from the station, we can change to another wave length to send our message, that other wave length being the one best suited for the local conditions. We call on 950 meters, for example. The operator is always listening for a call on that wave, so he will not lose it. Having received an answer, if there is a lot of interference in that vicinity, he will change to a much longer wave and send his message. And that flexible system has been found to be very practicable and it has greatly improved communication by that means. That is one of the greatest developments that has been made, and shows the especial necessity for standardization and for unit control. By having the naval stations all under one head at Washington, we have been able to use that wave-length regulation sensibly, so that there is now very much less interference between naval stations than before that condition obtained. And for that reason, I think, it is one of the chief reasons why we desire to have all of the stations on the shore end under a similar control. If there was an individual ether for each message, like we can have an individual wire for each message, I myself would not feel there was a necessity for this; but as there is but the one single ether and every one has to use that, and since the methods of tuning, developing of sharpness of wave length, etc., have not kept abreast with the requirements of the art, the chief way in which to prevent kicks is to have everything under one control.

The CHAIRMAN. We are very much obliged to you.

FURTHER STATEMENT OF COMMANDER DAVID W. TODD, UNITED STATES NAVY.

Commander TODD. May I say a few words more to supplement what these gentlemen have said and to round out the statement Lieut. Hooper made yesterday before the committee? He has been ordered out of the city and can not appear before the committee again.

Mr. GREENE. How long before you expect to be ordered away?

Commander TODD. I do not expect to be ordered away for two and one-half years from now. Mr. Hooper has not been ordered to sea. He was ordered away temporarily on specially important duties.

Mr. GREENE. These changes are made so often, I did not know if there was anything in the wind.

Commander TODD. No, sir. Ordinarily, in my position, I would stay fully there years ashore. My predecessor stayed nearly four years, but that was very unusual.

Mr. GREENE. Would it not be possible, you having this matter in charge, to stay longer by special arrangement?

Commander TODD. It could be specially arranged, sir; but it would jeopardize my career. I might make myself a sort of a radio scientist and a very poor naval officer. I must go to sea to learn my profession and to keep in the game, so to speak. We are all anxious to be known as sea-going officers, efficient on board ship above all else.

I still want to talk about the noninterference with the development of the art by the Navy Department activities. Although the art has advanced a great deal in the last 10 years, the advance has not been so great as to keep up with the standards set by the Navy Department. Whenever the art makes an advance the increased use of radio telegraphy offsets this advance. We have use for every single improvement that can be made. We always keep a little ahead of what the manufacturers can furnish; also of what the inventors can devise. The art's advance has been able, up to the present, to keep up only with what is absolutely necessary. Dr. Austin has said that the greatest advances have been made in the last four years, since we had radio regulation.

When we started out it may be said we were satisfied with the shorter wave lengths which are covered by the London and Berlin conventions. There is a special reservation of wave lengths between 600 and 1,600 meters. We did not ask for any more, but we have been compelled, as well as the commercial people, to extend into the higher wave lengths reaching up to 20,000 meters. That is partly, of course, to get away, both the commercial stations and ourselves, from one another and partly because we must have flexibility in our range of wave lengths in order to get away from the intentional interference of the ships of the enemy. The enemy, should we get into a war, will attempt to break up all of our communication by sending signals on the same wave lengths we use. Therefore we must have a wide range of wave lengths from which to choose, and methods for shifting from one to another every few signals, if necessary, and in that way to keep ahead of them. It is understood that some nations have elaborate arrangements for inter-

fering, and they have arrangements by which they can, at the same time they are interfering, get through their own communications. All this has been studied. We are doing the same thing and trying to do it better.

Mr. GREENE. Do you keep in touch with foreign improvements?
Commander TODD. Sir?

Mr. GREENE. Do you keep in touch with foreign improvements?

Commander TODD. Yes, sir; decidedly so. When this war commenced we sent an officer abroad, an expert operator. He was given exceptional facilities and, through his own tact and aggressiveness, he learned practically the entire system as far as one or two nations are concerned.

The system of purchasing apparatus, I should like to have the committee fully understand. Some of the companies opposed to this bill and this idea of Government ownership, are those who are profiting very largely from the encouragement the Navy has given them and the development of the manufacture of apparatus, in a very practical way, by purchasing it. We cooperate with their engineers as a whole and pick out certain ones to whom we give certain problems to develop. We buy from practically all the manufacturers of high-grade apparatus in the country—the Marconi Co., the Federal Co., Mr. Lowenstein, the Atlantic Communication Co., Mr. Simon, the National Electric Supply Co., the De Forest, the Radio Research Co., the Cutler-Hammer Co., the General Electric and the Western Electric, the Wireless Specialty Co., and the Wireless Improvement Co.

The CHAIRMAN. I have letters from some of those people favoring the provisions of the bill.

Commander TODD. Yes, sir. That is probably because they desire a more open market. They realize that the Navy Department will always buy in the market high-grade apparatus. They have the apparatus to sell, and so they want to favor us for the reason that we will have more stations and more need for apparatus if we get this complete control, especially the high-grade apparatus. We try in every way to develop these companies and to give them such work as their manufacturing facilities will stand.

Our principal sending sets for long-distance work, both for shore stations and ships, are known as arc sets, which we buy from the Federal Telegraph Co., the only company that can furnish satisfactory apparatus of that kind. The spark apparatus is for ships and coastal stations—we are at present buying two-thirds of it from the Marconi Co., and they are coming up to our specifications.

Mr. Clark touched on the question of calling in the engineers of these private concerns. These specifications are overhauled once a year, and the three stages of development of which we are taking advantage are these: First, we organize our service and decide what our future needs are. Once a year a board of all the officers of the Navy who have to do with radio telegraphy, either ashore or afloat, are gathered together, as far as practicable, and go over all the advances made in the past year and decide what may be possible during the coming year. With these requirements in view, after deciding on these, we have a conference with the radio engineers and manufacturing people and find out what they think they can do,

how many of these things they can make up, and then revise our specifications as a result of this conference. Then we advertise and buy in open competition, wherever a number of firms can supply the same thing without question. We require the firms to submit samples for test and buy the best apparatus offered.

If the art were in the hands of a commercial monopoly—could such a thing be obtained—the apparatus would be too greatly standardized. I am informed that the apparatus of the British Navy is suffering from this standardization and is far behind that of the Germans. We hear that it has developed since the war started along newer lines. It may be that they have suddenly thrown out a lot of apparatus and installed new; but there was too much standardization there before.

I now wish to touch on something that was asked me during the first day of my opportunity to address the committee—the question of whether or not the Navy Department pays royalties, and so on. I have since found out that we do take particular pains to remunerate inventive ability and genius for their efforts. The department has several contracts with prominent firms and individuals covering the purchase of apparatus and payment of royalties to those firms and individuals, which prove conclusively that we do not neglect that side of it and are perfectly fair whenever a business arrangement can be made; and right in there comes, possibly, a discussion of the patent situation. With special reference to one of the basic patents of radiotelegraphy known as “the four circuit patent.” This is used practically in all radio apparatus, both transmitters and receivers, and the claims of various people so overlap and have resulted in so much controversy that the Navy Department was not able to decide whether or not those claims were extravagant or real or otherwise, and the courts have not been able to do so, either. It is still in the courts; and it is on that same patent that the Government is being sued. We have to have the apparatus; that is the principal consideration involved; and not being able to decide these rival claims, we have to buy the apparatus from whoever will furnish it, use it, and let the courts decide.

Mr. BURKE. The Government does not lose anything anyway, does it?

Commander TODD. No, sir; in that it gets the apparatus it requires.

Mr. BURKE. They have to pay a royalty just the same.

Commander TODD. The result is a delay in getting their money. They claim the Court of Claims is a very long-winded and sorry way of getting their money and reaping a reward for their patent rights; but that is beside the question with us. We must have the apparatus and are not patent attorneys.

Mr. GREENE. And how about paying for these stations, if we take them over. Would they not have to go to the Court of Claims for that?

Commander TODD. No, sir. My idea would be that Congress would provide for a board or commission to investigate the matter and decide what would be a fair valuation as called for in the bill. We should have some men who know radio apparatus, others who know the value of buildings, towers, masts, and wires; others who

know the values of land in various parts of the United States. It should be a combination of technical and commercial men. I should say such a commission might very well be headed by a Member of Congress, and on the commission should be one or more business men and civilians of standing.

Concerning what the Commissioner of Patents, Mr. Ewing, said the other day, he gave the impression that the Government was not a good developer, because it is not in competition with anybody. Mr. Clark has touched on that, and we must say very positively that we have the greatest competition. We are in competition with all of the navies of the world. We must, in every way possible, try to get a hold on new devices and get them into use before the foreign governments do.

The CHAIRMAN. I think that is very well illustrated in the naval program. They are all the while trying to build newer and different types of battleships, larger battleships, bigger guns, and guns of longer range. I wish they would standardize, so we could. The same principle is involved in the development of the wireless, I presume.

Commander TODD. The same principle, sir. We are trying to provide now larger ships, with increased radio facilities and increased power—increased speed, gun power, and ammunition-carrying capacity, and what not. We are trying to keep ahead of other nations. It is well known that with anything we try to keep to ourselves we succeed only to a limited extent. Our advantage is temporary. Eventually the other side gets it. Naturally, what we must strive for is to have at all times devices aboard ships that will give us an advantage over the ships of another nation, something it has not yet found out; and to that end we try to keep our arrangements secret by keeping visitors out of our radio rooms, for fear somebody with foreign affiliations will inform them of our improvements; and we have begun to keep them out of our high-power stations. Later on we may have to do the same thing, possibly, with the coast stations.

We have the keenest competition, and let me emphasize the fact that radio apparatus that is of peculiar value for military purposes is also very valuable for commercial purposes in the same ratio. Valuable special devices are generally applicable to high-grade apparatus only. The military requirements are always very far beyond the commercial, and efficient apparatus for possible use in war is bound to be far ahead of the commercial apparatus which is built to cover certain limited needs only.

Mr. GREENE. May I ask how the compensation which you pay in the Navy compares with what is paid by private corporations for similar service in radio work?

Commander TODD. The Government as a rule has to pay more for apparatus—

Mr. GREENE. Not apparatus—I mean for talent. If you needed talent, what is your method of determining the compensation? How do you arrive at that? Is it arrived at by the Secretary of the Navy or is some board created for that purpose?

Commander TODD. No, sir; Congress makes an appropriation. It authorizes a certain sum to pay for a technical expert of such and such a type. We have no difficulty in getting the personnel of the

high type that we need. The commercial expert staff is, in a way, a sort of a shifting population, in that the companies themselves, while stable, are subject to their ups and downs—changes—with the result that first this year and then the next year a good man leaves the commercial field for the Government's service. We have absorbed a number of valuable men from the commercial field—two of them sitting over there—in the Navy Department and the Department of Commerce.

Mr. HADLEY. Did you say the department has to pay more for apparatus than commercial concerns?

Commander TODD. Yes, sir; because our specifications are more rigid, and they naturally put on a higher price because the Treasury has to be satisfied in so many ways that this money has been properly expended from a certain appropriation, that the payment is a little bit slower than it might be otherwise. We ordinarily do pay more, but the result is a much higher grade of apparatus than would satisfy the commercial companies. We are always ahead of the art, always ahead of the commercial companies.

A few more words about high-power stations. In the construction of high-power stations the wave length is not a governing factor except to a small degree. There are but few wave lengths in comparison with the number of high-power stations which commercial stations would wish to put in, say, 10 years; and if we do not put a limit now it will be more difficult to do so in 10 years from now and there will be greater embarrassment to the private companies who will then have much larger investments at stake. The location of stations must be controlled, as well as the number of high-power stations. If the companies are allowed to put up such stations, they will erect them near our stations, without much consideration of the matter of interference; whereas if the Navy is allowed to handle this matter they will be built in accordance with a general working plan, which is the only way to coordinate this work and get the maximum results. I hope to have here two other officers of the Government to speak in favor of this bill and the extension recommended providing for the purchase of high-power stations, as well as coastal stations. One is Dr. Rosa, Assistant Director of the Bureau of Standards, a scientist of international reputation, and the other is a representative of the State Department, to speak on the political aspect of this question.

Since this radio energy goes out in the space and covers vast distances in these days, international boundaries are affected. We either affect foreign stations or communication with them, and the State Department is very strongly interested in the question of neutrality, in that all neutrality regulations are not established entirely by the Navy Department, but after close communion with the State Department. In conjunction with the State Department we are working on a plan for increasing the good feeling between the Republics of the Western Hemisphere by having a Pan American Congress on the radio situation. A joint high commission went around South America some time ago and offered to them the idea of having an international Pan American radio system which would provide for commercial working from one port of South America to another, and so on to the United States, through high-power stations. The idea

was approved. The matter is still open. The Congress has not yet been held, but they have all, or nearly all, expressed approval of the plan, and have designated who will attend when the time comes. Now the question is, who is to provide the high-power service for this system?

The CHAIRMAN. That would depend on the convention, would it not?

Commander TODD. That would depend on the policy of the Government, sir.

The CHAIRMAN. I say it would depend on the developments of this conference, on the terms of the convention.

Commander TODD. No, sir; I would say it depends on the action of Congress in reference to this matter of Government control.

The CHAIRMAN. If the Governments of South America would take over and control all the stations, not only the shore stations, but the high-power stations, it would then become a more acute question whether or not our Government should go so far.

Commander TODD. Yes, sir. I see your point now. It would depend on whether they favored commercial high-power stations or intended to operate them themselves. If we allow a commercial company to furnish the North American station, there is one more station which is restricted before it comes into the world and which will still further restrict existing stations, Government and others; and looking forward to the Government's participation in this international working of high-power stations, the department is now preparing to erect in the center of the island of Porto Rico a high-power station of the first order which, in times of peace, we expect to use for communication with similar stations in South America; and should war come upon us this station would be of inestimable value in control of the fleet over the entire Atlantic and, incidentally, for the protection of the Panama Canal.

The CHAIRMAN. Is there any station, either Government or commercial, on the island of Porto Rico?

Commander TODD. Two stations, sir; one quite a good Government station, of what we call medium power, at San Juan, and one commercial station of much less interest, used only to communicate between two large sugar plantations, one in Santo Domingo, at Macoris, and the other at Guanica, P. R. San Juan and Guanica are the only stations in Porto Rico. This new station would be on high land, on a military road in the center of the island.

Mr. EDMONDS. By which one is the commercial work now handled?

Commander TODD. By both, sir.

Mr. EDMONDS. They both handle commercial work?

Commander TODD. Yes, sir. The Guanica station practically handles only matters in connection with the transportation of sugar from Santo Domingo to Porto Rico. It is principally for convenience in conducting their business, but I believe that they do handle commercial work.

Mr. EDMONDS. What radius do they have?

Commander TODD. With ships at sea, 150 or 200 miles, perhaps; and between the two shore stations I think the distance is greater. I can not verify that right now.

Mr. EDMONDS. Can they send commercial messages from Porto Rico here?

Commander TODD. Oh, no, sir; but we do.

Mr. EDMONDS. To Key West?

Commander TODD. The San Juan naval station does, by the use of arc apparatus.

Mr. EDMONDS. Then you virtually handle the commercial business there?

Commander TODD. Yes, sir; and we have been for four years, ever since the enactment of the present act, handling the commercial business with shipping there, as well as at Key West, Charleston, St. Augustine, Fla.—I will mention them all, if you wish.

Mr. EDMONDS. Is there much commercial business there?

Commander TODD. At San Juan, yes, sir; quite a lot, and a great deal at Key West. Key West, I should say, is almost our best station on account of the great volume of business it handles—there are so many ships that pass there. We manage to keep good operators there, they are among the most efficient we have. We are now making special arrangements to increase the possibilities of this station by installing what is known as distance control, or duplex working. That consists in taking the receiver of the radiostation to a distance and using it for receiving on special antennæ, with special wires, so as to get away from the immediate interference of the transmitter. That device, borrowed from commercial companies—there is no patent on it—is in use or rapidly being put in use at all the important naval stations. Arlington has it, as well as Boston, Charleston and others. I will be transgressing on this confidential organization, in a minute, which covers, substantially, an arrangement for working our stations to best advantage for the control of the fleet. At Key West, we are going to put this in primarily for commercial reasons. It enables the Key West Station to handle commercial work with distant stations—to send to them, and, at the same time, receive calls from merchant ships on much lower wave lengths, because the receiver has been removed to some distance from the transmitter. I should like to say that with the exception of one company—and there are a good many companies operating shore stations—none of them have taken up this idea which is not only being developed by the Navy, but developed into what promises to be a high state of perfection.

I have just a few words more to say. Mr. Clark spoke this morning of the opening of the San Diego (Cal.) Station. That has this distance-control feature, with very high steel towers that will stand any hurricane that blows and cost the Government \$300,000; and as Mr. Clark said, the preliminary tests are far beyond our expectations. It will be an extremely valuable link. The indications are that communication across the continent will be good at all times; but there is no use in that. The land wires are quite suitable for sending dispatches across the continent; and we have special Government rates, so that the cost is not high. What is this station to be used for? It is one of the high-power chain of stations for which Congress provided the money, to communicate especially with the Canal Zone and with Hawaii. Now here is a station with the best apparatus obtainable in the world, as far as we know, and the indications are that it is going to work with high efficiency, but will start work with a great handi-

cap. That station, when it does work, is going to limit the work of the commercial high-power stations in California, of which there are two. It is going to limit the work of the medium power commercial stations on the Pacific coast, of which there are three or four, to a lesser extent. It is going to limit the communications of the high-power stations in Hawaii.

There is a situation on the Pacific coast of considerable gravity, and the commercial companies' stations as well as the naval stations are requesting that some action be taken, by special board or otherwise, to straighten out the question of wave lengths again. Now, here comes another station to complicate the situation. It will be limited by the wave lengths in use. We can keep from interfering with our own stations, as they are all organized so as to keep from interfering with one another. We can shift our own wave lengths to a limited extent, but new ones suitable to the installations in the various stations are getting scarce. Fortunately this new high-power station can probably use long waves efficiently. In doing so it must choose one not in use, and slight changes by either commercial stations or ours will bother the others. At best we are dependent on the good will of our neighbors—and Hawaiian stations are also neighbors in this case.

MR. HADLEY. Can you state where the commercial stations are on the coast? I would like to get a statement in the record where they are and what are the high-power stations.

Commander TODD. The high-power stations on the Pacific coast are two in number; one belonging to the Marconi Co., at Bolinas, Cal., just north of San Francisco, and the other is just south of San Francisco and belongs to the Federal Telegraph Co. The medium-power stations are: First, the Federal Telegraph Co.'s station at San Diego, Cal.; and there is one at Los Angeles, San Francisco, and one at Lents, Oreg. The Marconi Co. has medium-power stations at Astoria, Oreg., and one in Alaska at a place called Ketchikan. The Navy has medium-power stations at the Mare Island Navy Yard, at the Puget Sound Navy Yard, and at Cordova, Alaska. The last two stations, at Cordova, Alaska, and the Puget Sound Navy Yard, represent our latest attempts to cover successfully the War Department's military cables between Alaska and Seattle.

MR. EDMONDS. Are there any private companies at Seattle and Tacoma, or up there on Puget Sound?

Commander TODD. Yes, sir; a Marconi station in Seattle, but it is not what you would call a medium power station; it is principally for communication with ships, although I believe it can communicate with commercial stations in Alaska.

MR. HADLEY. You have only named one commercial station in Alaska, and one at Astoria, Oreg.; are they all?

Commander TODD. Yes, sir; all the medium power stations except our Cordova station. When you come to the low-power stations, there are quite a number.

MR. HADLEY. Some on Puget Sound?

Commander TODD. Yes, sir; shall I name them all?

MR. HADLEY. No; I am satisfied so far as I am concerned. I wanted to get a general idea of the whole field on the coast.

Commander TODD. Quite a number of low-power stations, practically coastal stations as defined by the language of this bill. They primarily communicate with ships, although they do communicate with one another at times.

Mr. EDMONDS. They do not reach out, the low-power stations, more than 400 or 500 miles, do they?

Commander TODD. That depends on the circumstances. Generally about 100 to 200 miles. The matter is very complicated. The signals reach out farther over the water than over the land, ordinarily; they reach much farther in winter than in summer, and ordinarily much farther at night than during the day; and in the middle of the winter there are at times what we call "freak nights," where the signals are heard over tremendous distances.

Mr. HADLEY. I think they reach vessels going from Alaska to Puget Sound to a considerable extent.

Commander TODD. I beg pardon?

Mr. HADLEY. I say I think they reach vessels going from Alaska to Puget Sound and handle a great deal of commercial business.

Commander TODD. They do handle a great deal.

Mr. HADLEY. I think there are some of the low-power stations that cover a considerable portion of that territory.

Commander TODD. The Navy covers all outside waters of Alaska, and the Marconi stations cover all interior waters up as far as Juneau, while between Alaska and Puget Sound are a number of Canadian Government stations. During the summer the salmon industries have quite a number of stations at their canneries. Speaking of those freak nights we hear sometimes of the most astounding long-distance work in intercepting the ordinary interchange of messages between one station and another; and the latest I have in mind is an operator in New South Wales, Australia, who sent to us certain matter intercepted which, by the call letters, indicated that this matter was sent by the Tuckerton Station here in New Jersey. We were able to identify for him satisfactorily parts of commercial messages transmitted by Sayville and Tuckerton to Germany. I can not give you the distance, but it is all of 10,000 miles.

The CHAIRMAN. Is there anything further?

Commander TODD. Just a few words more. The San Diego station, put up with all this expenditure of time and money and effort, is going to be limited from the outset in its usefulness to the Government. When the Hawaiian station is put up, that will be still further limited on account of the very close proximity of other stations, and we are going to interfere with them. We are going to reduce the hours during which they can work, and they ours. We are not going to be satisfied, of course, to have those stations fully manned and not handle any business at all just to keep them there waiting for a possible war. We can not do that. We have to handle at least the Navy business between Hawaii and California with the San Diego station, and later, between Hawaii and the Philippines. Besides the Navy Department business there is the War Department in the Philippines and Hawaii, and that of all other departments of the Government; and there is the insular government of the Philippines. If we were to try to restrict the Government work of these stations so as to allow the commercial

people to have, say, three-quarters of the time, or all except sometimes when they did not need to work, the insular government and all other interests in the Philippines would say, "We can not see the sense in our paying these high cable rates when the Government has this reliable means of communication. We have paid so much for it; it may mean a tremendous advantage in time of war, but this war business is very indefinite. In the meantime can we not get some use out of these stations?" The answer would be, "We can, if convenient to the commercial companies," unless you gentlemen will give us some relief. Science is advancing, but not fast enough. Now is the time, before the business interests of those companies develop to a greater extent than at present. They do not want to sell out; they see a great field ahead of them, or they think they do. We do not see it. We see only trouble in the future, more expense to the country, and inefficient working up to the time when Congress does take the action which we hope will result from our efforts at this time.

Mr. ROWE. Would the bill we have under consideration here eliminate the difficulty on the Pacific?

Commander TODD. No, sir; that would not in any way affect the situation except for the very mild little sentence saying that commercial stations, that is, those that communicate between fixed points, shall operate so as not to interfere with existing stations—or some such words.

Mr. HADLEY. Would it cover it if the commercial stations were taken over in the outlying island possessions?

Commander TODD. I did not understand the question, sir.

Mr. HADLEY. In line with that last question, I say, would this bill cover the Pacific situation if the commercial stations in the outlying possessions were all taken over under the bill, and the others were excepted?

Commander TODD. That would improve the receiving in the outlying possessions; but these communications are both ways. For instance, the California coast station could send to Hawaii and Hawaii could receive successfully if the interference were eliminated at that point, and Hawaii could send to Samoa and could send to Guam, and so on, and could send to the Philippines. All of that part of it would be all right; but as soon as Hawaii started to send back to the Pacific coast the possibilities would depend entirely on what arrangements we could make with the commercial companies or whether or not the commercial companies are working at the time. We, of course, could answer by cable.

Mr. HADLEY. What I mean more particularly is the elimination of the commercial stations on shore, on the Pacific coast, is not essential to the Navy's interest in the outlying possessions.

Commander TODD. It is very essential. We could send all the messages we pleased to the outlying possessions, and thereby interfere with the commercial people to some extent; but we could not get any information back with any assurance; we could not be assured of it unless restrictive regulations were made—not only restrictive on the commercial people, but on ourselves. Of course, the radio companies might find it unprofitable to operate only one end of the California-Hawaii commercial business.

Mr. EDMONDS. What, eventually, will be the outcome of the development of the wireless on the cable companies, whether you do it or whether it is done by commercial interests? Is it going to drive the cable companies out of business?

Commander TODD. No, sir; for this reason: The possibilities of radio communication are limited. We have no scientists who will tell us—I mean real scientists—that it will ever be possible to send any number of communications through the common ether at the same time; and while there will be some business for long-distance radiotelegraphy in competition with the cables, there will never be enough to drive the cables out of business if the cables are efficiently operated.

Mr. EDMONDS. It would strike me that it would be rather a bad state of affairs, considering the present development of wireless, to lose the cables; because it seems that the radio communication is so indefinite that you could never count on it as being a sure thing. And if it is going to drive the cables out of business, it would not be a very good thing to develop it to that extent.

Commander TODD. I can state positively—positively is a pretty strong word, perhaps—but I can state that the possibility of driving any cables except broken-down cables, poorly operated, out of business is very remote. Of course, the broken-down cables will either be driven out of business or they will have to be put in efficient condition. Radiotelegraphy will result in an increased efficiency of the commercial cables, because as soon as one side or the other commences to fall down on the work, the traffic will go to the other, and, especially in view of the fact that the first cost of radio communication between two points is very much less than the first cost of a cable. Once laid, the cable is more reliable; it has been, up to date.

The CHAIRMAN. The service will be cheaper anyhow, the rate by cable, than by wireless?

Commander TODD. That has not adjusted itself yet, sir. At present commercial companies who are competing with cables think they are doing it very successfully.

The CHAIRMAN. In rates?

Commander TODD. In rates; yes, sir. They have reduced the rates materially and claim to be making money. That has yet to be shown, however. It is quite true that the Sayville and Tuckerton stations are now making considerable money; but the reason is there is no cable to Germany.

The CHAIRMAN. There is no secrecy about wireless communications, is there?

Commander TODD. No secrecy, unless——

The CHAIRMAN. Everybody can listen in and tell what the other fellow is talking about?

Commander TODD. Yes, sir; exactly.

The CHAIRMAN. For that reason, it seems to me, it never can put the cable or the telegraph out of business.

Mr. EDMONDS. The only thought I had, Mr. Chairman, was it might cripple them to such an extent that the cable companies would not pay and would be abandoned. That is the only thing. But they each seem to have a distinct field of their own at the present time.

The CHAIRMAN. There is a secrecy about cable communications or communications by telegraph that seems to be impossible now by wireless, and for that reason most of the confidential communications naturally would go by cable or by wire, unless you wanted everybody in the world to know what you were talking about.

Mr. EDMONDS. They can use the cipher, of course.

The CHAIRMAN. Yes, I know; but that is a very cumbersome way of doing business.

Mr. EDMONDS. I would like to ask Commander Todd another question. I do not want you to tell me anything that is considered as a secret by the Navy Department, but I would like to know whether these ordinary stations, the Marconi and others, could be used for the control of submarines and torpedoes, and so on, as they are talking of doing nowadays, through this invention that has been talked about recently.

Commander TODD. I can not talk much about that matter sir. As it happens—

Mr. EDMONDS. There has been recently quite a little publicity about those things, you know, and I am only talking from what I have read in the newspapers about the control of submarines and torpedoes by the wireless waves.

The CHAIRMAN. The John Hays Hammond, jr., experiments?

Mr. EDMONDS. Yes. I was wondering whether the same apparatus or character of station as the shore stations could be used for that purpose.

Commander TODD. I can answer that question. It does take special devices, but undoubtedly some of the apparatus in a shore station—I do not know how much—could be adapted to this purpose. Generally speaking, it takes a very special, high-grade type of apparatus to do this in Mr. Hammond's plant. When I said that some of the apparatus in the ordinary commercial station could be used, I was thinking more of the masts and the wires than the apparatus.

Mr. EDMONDS. The reason I ask you that is this: Would a shore station in the hands of an unfriendly operator be able to be used to handle an enemy's torpedo, or something like that, from the shore, with the apparatus they at present have on hand?

Commander TODD. No, sir. They would have to have very special devices. I can say this because it has been said and printed in hearings before some committee of Congress, that Mr. Hammond claims to have solved the question of noninterference, and experiments have shown that he has to some extent. The ordinary station could exercise no control over these torpedoes. We would have to have special transmitters and to know the inner workings of the torpedo-carrying motor boat to do it.

I think that is all I have to say.

The CHAIRMAN. I have some communications here from the various executive departments. Here is a communication from the Department of Commerce. I believe Mr. Chamberlain has already put that in the record. (See pp. 63-66.)

I also have a communication from the Treasury Department, which was read by Lieut. Waesche. (See pp. 70-72.)

Here is a communication from the Department of Labor. They had a representative on the committee which drafted this bill, and

this is a letter from the Secretary of Labor in reference to the bill now before the committee. If there is no objection, I will have it printed in the record.

(The letter above referred to is as follows:)

JANUARY 9, 1917.

Hon. JOSHUA W. ALEXANDER,

Committee on Merchant Marine and Fisheries,

House of Representatives.

MY DEAR CONGRESSMAN: I have the honor to acknowledge the receipt of your letter of the 23d ultimo in which you call attention to the bill (H. R. 19350) to regulate radio communication, a copy of which you inclose. You ask that I give your committee the benefit of such suggestions as I may care to make regarding the desirability of enacting the bill into law.

Taking the bill as a whole I regard it as a very desirable measure—one which is very much needed and which will go a long way toward remedying evils and difficulties which the experience so far had with radio communication has demonstrated to exist and to require some well-devised and comprehensive action on the part of the Federal Legislature.

When an interdepartmental committee was formed, something over a year ago, with the purpose of having a thorough study made of the problems which have arisen and which are likely to arise in connection with this recently developed method of electrical communication, and when selecting a representative of this department to serve upon that committee, I expressed the opinion that, in view of the fact that radio communication can not be confined to definite channels to which specific title could be conveyed to individuals or corporations, it ought to be owned and controlled by the Government. Soon after the interdepartmental committee met and organized it requested the heads of the various administrative departments to express a definite opinion as to whether the committee in carrying on its work should have in view the actual acquirement of all existing radio stations, or how far in that direction the bill which it was proposed to draw should go. To this communication I replied by restating the opinion which I had expressed at the outset in detailing a representative. The report submitted to this department by its representative after the committee had completed its labor, the results of which constitute the draft of the proposed measure now under consideration by your committee, shows that the said representative and those serving upon the committee as representatives of the military branches advocated throughout the deliberations of that body the ownership by the Government of the wireless telegraph; that the drafted measure, like all productions of its kind, in the formulation of which a number of individuals take part, is to a considerable extent in a number of its features the outcome of compromise between the members of the committee who entertained various views concerning this subject.

I have had no reason to change my mind on this very important question. Upon reading the report of the department's representative and considering the various provisions of the measure produced in the manner above described by the interdepartmental committee, I am more than ever convinced that Government ownership is the real solution of our radio communication problems. I observe that there are many provisions in the drafted bill that tend toward ultimate Government ownership; but I wish to direct attention to two provisions in particular, one of which I think logically constitutes an argument in favor of going further in that direction than the bill at present does, and the other of which I think should be materially changed in order to hasten the ownership by the Government of at least that part of the wireless telegraph business which it is of the greatest importance that the Government shall absolutely control, for reasons of a military, neutrality, and commercial nature.

It is provided in the next to the last paragraph of section 5 (p. 6, line 16, to p. 7, line 2) that in the Philippine Islands, in the Canal Zone, in certain United States territory in the West India Islands, and in a geographically defined section of the Pacific Ocean no private radio station shall hereafter be operated on land or on a permanently moored vessel. It is understood, of course, that this step toward Government monopoly can readily be taken because the field involved has been occupied quite completely with Government stations and that stations controlled as private enterprises have not been erected within such territory. But it seems to me that if it is sound upon principle to contend that the Government should have a monopoly of wireless telegraph in these par-

ticular sections, by the same token that system of electrical communication should be a Government monopoly elsewhere.

Section 6 of the proposed measure (p. 7, lines 7-13) I think would be very much improved if changed to read substantially as follows:

"Sec. 6. That after three months from the passage of this act the Government, through the Navy Department, shall have authority to acquire, by condemnation proceedings, any radio station now in operation in the United States."

Commending to the very careful consideration of your committee the suggestion made above, I beg to subscribe myself,

Very truly, yours,

W. B. WILSON, *Secretary.*

There is also a letter here from Hon. Franklin K. Lane, Secretary of the Interior. It is very short and approves of the purposes of the bill.

(The letter referred to is as follows:)

DECEMBER 29, 1916.

DEAR MR. ALEXANDER: Replying to your letter of December 23, requesting report upon H. R. 19350, a bill "To regulate radiocommunication," I have to advise you that this bill is in the form approved by the interdepartmental committee, which was organized for the purpose of considering this question and suggesting appropriate legislation.

The Interior Department is not directly concerned, but I approve of the object sought to be attained by the bill, and know of no reason why it should not be enacted.

Cordially, yours,

FRANKLIN K. LANE, *Secretary.*

There is also a letter from Secretary Baker, Secretary of War, which reads as follows:

WAR DEPARTMENT,
Washington, January 18, 1917.

Hon. JOSHUA W. ALEXANDER,
Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives.

SIR: In reply to your letter of December 23, 1916, I beg leave to state that I consider the bill introduced by you on December 22, 1916, to regulate radiocommunication (H. R. 19350), a most important measure, and one that should be enacted into law as soon as possible.

I firmly believe that the provisions of this bill when enacted into law will prove of inestimable value to the Government by enabling it to regulate radiocommunication in a way which will increase the efficiency of both the Army and Navy in war or national emergency.

Yours, very truly,

NEWTON D. BAKER,
Secretary of War.

The communication from the Postmaster General has already been put in the record by the chief clerk of that department, Mr. Denning, so we will not duplicate that. (See p. 96.)

Here is a communication from the Navy Department. I do not believe this has gone into the record.

Commander TODD. It has not, sir.

The CHAIRMAN. If there is no objection, that will also be incorporated in the record.

(The letter from the Secretary of the Navy is as follows:)

DECEMBER 29 1916.

SIR: I have the honor to acknowledge the receipt of a copy of a bill to regulate radio communication (H. R. 19350), forwarded with your letter of December 23, 1916, requesting suggestions touching the merits of the bill and the propriety of its passage. The bill is an excellent and necessary measure, and the department approves it and recommends its passage, subject to the following remarks:

The Navy Department is the principal user and the most extensive buyer of radio apparatus in the United States. It has had the strongest influence in building apparatus since the early days of the use of radiotelegraphy in this

country by constantly requiring manufacturers to incorporate new ideas which the department has found necessary. In addition, from the operation of 51 stations, used for all purposes for which radio is suitable and necessary, the largest experience has been gained concerning the operative features of radio apparatus, and it is convinced that Government operation and control of all stations used for commercial purposes, other than those on board merchant ships, is necessary on account of the mutual interference between stations and for other reasons given below.

This mutual interference between stations has always been a very serious question. Many inventors have been and are working on the problem and great improvements in apparatus and methods have resulted, but the number of installations and the consequent extension of radio communication have increased faster than science has increased its possibilities as regards non-interference, while the constantly increasing distances over which these communications take place increase the difficulty to a very great extent. The net result is that the number of communications that can take place at the same time in a given area is still limited. One station or system must wait for another to finish; there are many chances for disputes, which sometimes are carried on between operators by radio, especially when the operators are not under strict control, adding to the time wasted. There is needless duplication of effort, and in cases of distress the confusion resulting from many interests attempting to render aid, get news, or satisfy curiosity, is very dangerous. To permit the greatest amount of business, Government and commercial, being done through consistent changes in apparatus, through systematic apportionment of and prompt and frequent changes of wave lengths, and through standardized methods of operating, one management is necessary.

For other reasons, radiotelegraphy has been looked upon as a natural Government monopoly. Since only by the closest regulation can the best use of this art be obtained, not only for commerce and safety at sea, but for military purposes, radiotelegraphy is a strict Government monopoly with the larger number of foreign nations, and in these foreign countries where commercial stations are permitted the Government control is generally so strong as to amount to a monopoly.

The difficulties of maintaining the radio neutrality of the United States during the present war have been real, in spite of earnest attempts on the part of commercial radio companies to cooperate with the department. The possibilities of unneutral service by sending of messages from stations in the United States containing information of military value to one side or the other are very great, while commercial radio stations under other than Government control can give out information of incalculable value during that twilight period which would probably precede the opening of any war to which this country might be a party. Authority to take over and operate or to close commercial stations in time of war will not suffice. The stations must be in full Government operation before the first hint of possible hostilities. In this connection, since an alien operating on board an American ship to-day can perform unneutral service without the knowledge of the master which can result in the capture or sinking of the ship, I have to recommend that the words "except for the operation of a station on shipboard" in the fifteenth and sixteenth lines on page 14, be omitted. Provision should be made, however, for the temporary employment of an alien operator for service on an American ship in emergencies, but no American ship should be allowed, ordinarily, to leave a port of the United States except with operators who are United States citizens.

The prime necessity for efficient radio communication with the fleet and with outlying naval bases is apparent, and the only way that the Navy can be assured that this communication is ready and working at top-notch efficiency when hostilities are imminent, is to have these stations working constantly in times of peace. Only by constant use can stations and operators be kept efficient. It is invariably the case that the station that handle the most business by radio is the most efficient, and develops the best operators.

This necessity for military radio communication was recognized early and a system of naval stations on both coasts and at the principal outlying points belonging to the United States was established over 10 years ago through the liberality of Congress. This has been gradually extended to include more efficient service in the Canal Zone, in Alaska, in the Pacific, and on the Gulf of Mexico, by the addition of stations, and everywhere by continuous increase in efficiency and apparatus. Every new device has been tested as soon as practicable and put into use in the stations and on board ship. Since the Govern-

ment must have this system for its control of the fleet, and for other Government business, which includes communication with Army transports, Coast Guard vessels, lighthouse tenders, light ships, weather reports, storm warnings, time signal service, hydrographic information, and safety of life at sea, it is a needless duplication of capital and effort to permit private stations to operate where they can interfere with each other and with the military and other Government work of stations and where the Government stations can easily handle commercial work in times of peace; work that would be interrupted or partially suspended in time of war. Congress recognized this in 1912, in passing the radio act now in force, and since that time the department has been successfully handling commercial radio work at a number of its stations. At present there are 23 stations handling commercial work very successfully and efficiently, turning the receipts into the Treasury. The department has been looking forward to increasing its possibilities in this regard by installing distant control at certain points, which device enables a station to work with merchant ships and with naval ships, or distant radio stations at the same time. The department is ready and willing to take up all radio communication between ship and shore and any other necessary radio communication.

The idea of the Government ownership of all stations handling commercial business, except ship stations, is not a new one. A number of official reports have recommended it. As early as March 22, 1910, this department, in a letter to your committee wrote the following:

"This department, in connection with the War Department and the Department of Commerce and Labor, has for many years sought the enactment of legislation that would bring some sort of order out of the turbulent condition of radio communication, and while it would favor the passage of a law placing all of the wireless stations under the control of the Government, at the same time recognizes that such a law, passed at the present time, might not be acceptable to the people of this country. However, it is not at all certain that the commercial limitations of the art might not in the future impose such an obligation upon the Government."

It is noted that the bill looks forward to such ownership in several provisions, such as:

(a) Excluding all but Government installations in certain localities where commercial radio stations have not been built.

(b) Opening Government-owned stations to commercial business in competition with existing commercial stations.

(c) Providing for the purchase of coastal stations which owners may desire to sell.

The bill covers the purchase of coastal stations only—that is, only those used to communicate with ships, and by permitting the Navy Department to open all of its stations to commercial business, discourages the extension of any existing commercial systems or the organization of new systems. The department strongly recommends that the committee provide for the purchase of all stations used for commercial purposes. Attention is invited to the increasing number of stations. In some cases the value of existing stations is constantly increasing, and decisive action at this time will result in a saving of the public funds.

In accordance with the above, I have to recommend that section 6 of the bill provides for the purchase through the Navy Department of all existing coastal and commercial stations in the United States, Alaska, Hawaii, Porto Rico, and the Swan Islands within two years at reasonable valuation and that no license be granted to any such station for operation after two years from the date of passage of the bill.

The other provisions of the bill, especially those pertaining to ownership, licensing, and control of stations by the Department of Commerce, are admirable and I heartily indorse them all. These provisions cover well the regulation of all stations other than those defined in section 2, first and third definitions, and should apply to these until they are acquired by the Government.

Firmly convinced that the above provisions are absolutely necessary for the best interests of the Nation, I do not hesitate to recommend that this matter be considered urgent. Delay will increase not only the difficulties under which we are now working, but the cost of providing the ultimate remedy.

Sincerely yours,

JOSEPHUS DANIELS.

Hon. J. W. ALEXANDER, M. C.,

*Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives.*

Then here is a letter from the Merritt & Chapman Derrick & Wrecking Co., which reads as follows.

NEW YORK, January 12, 1917.

Hon. J. W. ALEXANDER,

*Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives.*

DEAR SIR: In reference to the bill now before your committee to regulate radio communication, we beg to strongly indorse this measure, as we believe it to be of great benefit to the merchant marine in general.

Yours, very respectfully,

MERRITT & CHAPMAN DERRICK & WRECKING Co.,
By J. T. MERRITT, *President.*

Also a communication from the American Radio Relay League, with headquarters at Hartford, Conn., which is signed by Hiram Percy Maxim, president. I can read it, if you wish, or simply incorporate it in the record.

Mr. EDMONDS. Is it indorsing the bill, or against it?

The CHAIRMAN. It says:

JANUARY 11, 1917.

Judge J. W. ALEXANDER,

Chairman House Committee on the Merchant Marine and Fisheries.

GENTLEMEN: At the hearing to-day on the radio bill it was evident that there would be no opportunity for me to be heard for some days, and as my business prohibits my remaining in Washington beyond to-day, I am compelled to submit in writing what I had hoped to be able to tell your committee in person.

The American Radio Relay League, of which I am president, is an organization of approximately 5,000 amateur radio station owners scattered in all the States of the Union. Our object is the perfection of radio relay routes by means of which messages may be sent between private citizens in any part of the country free from all charge. We have been in operation since May, 1914, and at present are handling between 100 and 500 relay messages every night. Some of our stations have handled over 40 messages in a single night. We are rapidly growing and improving our organization and I am justified in stating that in another two years' time, if no legislative obstructions prevent, we will be able to handle a large volume of traffic from the Atlantic to the Pacific coasts and from points over the border in Canada to points over the border in Mexico.

Our membership is not limited to young men, but an ever increasing number of men of affairs and of mature years are joining us in this work. I have considered carefully the proposed radio bill and I desire to go on record as approving those parts of it which concern amateurs, because I believe its enactment into law will reduce radio interference which is now the greatest difficulty which confronts us. I recognize that the proposed bill will confer greater powers upon the Navy Department, Department of Commerce, and upon the President in dealing with us amateurs; but I believe these greater powers will help our work rather than retard it. These authorities can not but appreciate that it is from the ranks of us so-called amateurs that the talent necessary to carry on both Government and commercial radio work is principally drawn; that we amateurs and the many manufacturers whom we support have already been the source of several valuable improvements in radio science, and that in time of public need our well-organized relay trunk lines and our very efficient stations in the various States of the Union might easily be of incalculable value to our country.

I repeat, I am in favor of the proposed radio bill, and hope that adequate appropriations will be made to enforce it after passage.

Respectfully,

THE AMERICAN RADIO RELAY LEAGUE,
HIRAM PERCY MAXIM, *President.*

I also have here a communication from Mr. Stewart, the chairman of the Wireless Association of Pennsylvania. He was here the other day but was called away and may not be able to get back. I

told him in the event he could not return I would have this statement incorporated in the record. Is there objection?

Mr. ROWE. Suppose we wait, before putting his statement in the record, until we see whether he can appear personally.

The CHAIRMAN. I think he may have some suggestions to make about the bill, if he comes. If he does not, I will put his statement in the record later on.

Mr. GREENE. Have the proponents of the bill said all they desire?

Commander TODD. Yes. I regret that the Bureau of Standards and the State Department could not be represented.

The CHAIRMAN. Those opposed to the bill, or who may criticize some of its provisions and suggest amendments are to be heard beginning to-morrow and the proponents will have an opportunity to be heard in rejoinder.

Commander TODD. I had hoped that the State Department representative could have been heard before the end, but I have given him up. What he had to say has no relation whatever to what any opposition may develop. His statement should be entirely from the broad viewpoint of what we are trying to bring about, the safety of the country and the proper political relations with our neighbors as affected by this question.

The CHAIRMAN. I have a telegram from a representative of the Mutual Telephone Co., of Hawaii. They have a station at Honolulu, and they have an interisland wireless system. One of their representatives called on me the other day and said they were sending a representative here to be heard, but it would take 10 or 12 days for him to arrive. That was some time early last week. I told him to go ahead and get him here, and he said he would arrive by the 25th. Of course, I assume we will be glad to hear from him when he comes.

Mr. GREENE. When do you propose to begin the hearing for the opponents of the bill?

The CHAIRMAN. To-morrow. Now, here are some telegrams. The first is dated New York, January 17, from the Kilbourne & Clark Manufacturing Co., as follows:

Mr. J. W. ALEXANDER,

Chairman Committee on the Merchant Marine, Washington:

I wish to indorse and urge the passage of H. R. 19350, now pending in the House of Representatives. I believe that this bill as drawn will work out satisfactorily and to the best interest of all concerned. I most heartily approve of sections 5 and 6. My firm is engaged in the manufacture and installation of radiotelegraph equipment.

Are they manufacturers of radio apparatus?

Commander TODD. Yes, sir; they equip ships and coastal stations.

The CHAIRMAN. Another telegram, dated New York, January 11, 1917, addressed to Hon. Joshua W. Alexander, etc., as follows:

The maritime association of the port of New York heartily indorses H. R. 19350, to regulate radio communication, and strongly urge its passage. The naval-communication service is of inestimable value to shipping in general, and Congress should encourage use of same by permitting all naval radio stations to accept business from any ship regardless of radio system employed.

The telegram is signed Joseph B. Morrell, president.

Also a telegram from New York, dated January 10, 1917, addressed to me, from the Union Sulphur Co., traffic department, as follows:

Referring to the pending bill for radio matter in which is involved the question of opening all radio stations to general public service, we wish to emphati-

cally state that we favor the opening of such stations, as we feel it is a step in the right direction and would be of great benefit to American shipping. We would be very glad to have you convey this information to your committee.

Then, here is a letter from the Attorney General, which I do not think it is worth while to put in the record. I will read it to the committee, however. Of course, they had a representative on the inter-departmental committee, and he perhaps helped to frame the neutrality provision.

Commander TODD. Yes, sir; and principally in connection with the legal phraseology of the bill.

The CHAIRMAN. Here is a letter from the Luckenbach Steamship Co., of New York, dated January 13, 1917, reading as follows:

Your circular letter of the 8th instant, inclosing H. R. 19350, to regulate radio communication, is acknowledged.

We regret we will be unable to attend the hearing on this bill. At the same time, we are heartily in favor of any measures which will improve the handling of our radio business, and we believe it would be better if all shore stations were in charge of the Government, as this would obviate the possibility of messages being blocked or jammed by coast stations belonging to different owners than those of the ships' stations.

The letter is signed by H. P. Hamilton, general manager.

Another letter from the Atlantic Communication Co. (Telefunken system of wireless telegraphy), 90 West Broad Street, New York City, addressed to Hon. Joshua W. Alexander, etc.:

DEAR SIR: Your recent favor was duly received.

Owing to the fact that a majority of the stockholders of this company are not accessible, it is impossible to call a meeting and have them express an opinion. The officers and directors of this company, however, all of whom are American citizens, feel that Government control of wireless telegraphy will eventually become a necessity, the more so as such control has been established in most foreign countries.

We further wish to state that it has always been the attitude of this company to cooperate cheerfully with the Government in every way, which will undoubtedly be confirmed by the officers of the Navy Department.

We thank the committee for the invitation to present our views, but feel that we could not state them more explicitly by appearing at the present time.

Yours, respectfully,

H. W. METZ, *President.*

DR. K. G. FRANK, *Secretary and Treasurer.*

Commander TODD. I would like to call attention to the fact that that company is the owner of the Sayville station which is now communicating with Germany.

The CHAIRMAN. I had heard that statement made, but I did not know it was a fact.

Commander TODD. That is a fact. They are the owners of the Sayville station.

The CHAIRMAN. Let the record show the fact that the Atlantic Communication Co. is the owner of the Sayville station.

Commander TODD. Which is one of the most efficient of the high-powered stations in the country.

The CHAIRMAN. Then there is a letter from Richard Pfund, special radio apparatus, 111 Broadway, New York, dated January 10, 1917, addressed to me as chairman of the committee, he says:

Thank you for your favor of the 8th instant and the inclosed copy of H. R. 19350, to regulate radio communication, and I regret that I shall hardly be able to attend the hearings on this measure, because I am very busy with some appa-

ratus for the Signal Corps, upon which I am away behind on account of existing conditions.

I consider the proposed regulations most necessary, and not only for the proper conduct of radio communication in the United States, but also for the future safety of the country, and am absolutely unable to agree with those interests who are so strenuously opposing them, through various channels, and for one flimsy reason or another. Those loudest in their opposition, I have very excellent reasons for believing to be opposed solely because of their more or less direct, and more or less secret alliance with the foreign interests, who, in the guise of an American corporation, and in the guise of a commercial station, actually planted a high-power station on United States soil, and similar stations elsewhere in this hemisphere under other pretexts, which stations were primarily intended to serve a military purpose, and a by no means friendly purpose.

I am also absolutely unable to agree with the statement that these regulations would "stifle" wireless telegraphy in the United States, but believe that, among other benefits, they would also help to very "effectively stifle" the permanent separating of a multitude of small and inexperienced investors from their hard-earned savings, to be squandered in miscellaneous sinecures and unnecessary and antique stations for which there is no real demand or reasonable chance of return.

I sincerely hope that your honorable committee will be able to see its way clear to recommending the passage of this highly desirable and highly meritorious bill.

Very truly, yours,

RICHARD PFUND.

Also a letter from the Southern Pacific Co., dated New York, January 13, 1917:

DEAR SIR: Beg to acknowledge receipt of your letter dated January 8, 1917, concerning hearings to be held by the Committee on the Merchant Marine and Fisheries, on H. R. 19350, to regulate radio communication.

This company is interested in the measure, but will not be represented at the hearings, and I am, therefore, giving you an expression of our views on the subject, as suggested in your letter.

Under our present arrangement with the wireless company, which owns and operates adequate shore stations, we have unrestricted communication between ships and shore stations on official business of the company, enabling us to communicate with our ships, and they, in turn, can communicate with owners without charge.

It occurs to me that in the event the Government took over all wireless stations we would be denied the privilege, and be compelled to pay tolls on all official messages between ships and shore stations relating to strictly company business.

This is one objection to the bill, and if it will not mean the revocation of such privileges, or that shipowners' messages will be sidetracked for Government business, there will be no opposition on our part to its passage.

There are some other features that may cause some trouble for the shipowners, particularly the supplying of wireless operators and necessity of purchasing our own wireless equipment, in all probability creating an increase in cost of wages for wireless operators.

Yours truly,

C. W. JUNGEN.

I would also like to place in the record the following letter from the Kilbourne & Clark Manufacturing Co., manufacturers of electrical apparatus:

SEATTLE, U. S. A., January 12, 1917.

Hon. J. W. ALEXANDER,

*Chairman Committee on The Merchant Marine and Fisheries,
House of Representatives, Washington, D. C.*

SIR: In response to your favor of the 8th instant, including a printed copy of H. R. 19350, a bill to regulate radio communication, we are pleased to advise you as follows:

We are in favor of the passage of this bill without amendment. We believe that, if it becomes a law, progress in the art of radio communication will be

greatly accelerated because of either greater governmental control or complete administration of coastal radiotelegraph stations. We are of the opinion that closer supervision of such stations by the Government is of vital importance in the process of creating a greater American merchant marine; aside from the fact, which should be undisputed, that national supervision or outright ownership is desirable for military reasons.

We are engaged in the manufacture of radiotelegraph apparatus and sell our product outright to shipowners. It is of interest to us and our customers to know that ships equipped with independent radiotelegraph sets shall at all times be able to communicate upon equal terms with any other radiotelegraph station either afloat or ashore.

From the standpoint, at least, of all shipowners who own and operate their own radiotelegraph equipment, and of all manufacturers thereof, who sell their apparatus and are not engaged in its operation, there can be no doubt as to the desirability of the enactment of this law.

Very respectfully,

KILBOURNE & CLARK Mfg. Co.,
By FRED'K G. SIMPSON,
Treasurer and General Manager.

Also the following telegrams:

SEATTLE, WASH., *January 18, 1917.*

MERCHANT MARINE AND FISHERIES COMMITTEE,
Office Building, Washington, D. C.:

As a company who operates its own radio apparatus aboard steamships, we approve and respectfully urge for passage radio bill H. R. 19350.

PUGET SOUND TUGBOAT Co.

SEATTLE, WASH., *January 18, 1917.*

MERCHANT MARINE AND FISHERIES COMMITTEE,
Office Building, Washington, D. C.:

Owning and operating our own vessels in the fishing trade, some equipped with wireless, we respectively urge the passage of radio bill H. R. 19350.

SAN JUAN FISHING & PKG. Co.

TACOMA, WASH., *January 18, 1917.*

MERCHANT MARINE AND FISHERIES COMMITTEE,
Office Building, Washington, D. C.:

We strongly approve and respectfully urge for passage radio bill H. R. 19350.

PACIFIC STEAMSHIP Co.,
H. F. ALEXANDER, *President.*

SEATTLE, WASH., *January 18, 1917*

MERCHANT MARINE AND FISHERIES COMMITTEE,
House Office Building, Washington, D. C.:

We strongly approve and respectfully urge for passage radio bill H. R. 19350.

ALASKA STEAMSHIP Co.

SEATTLE, WASH., *January 18, 1917*

MERCHANT MARINE AND FISHERIES COMMITTEE,
Office Building, Washington, D. C.:

As a company who operates its own radio apparatus aboard steamships, we approve and respectfully urge for passage radio bill, H. R. 19350.

BOOTH FISHERIES Co.

I do not understand this bill interferes in any way with the privilege of buying equipment from anybody they please.

Commander TODD. It does not, sir.

The CHAIRMAN. They have a monopoly now, I suppose, and do not desire to give it up; they have certain contracts which they do not care to give up.

Commander TODD. They have contracts with the Marconi Co., which company furnishes the apparatus and operators on a rental basis.

The CHAIRMAN. That is all I have at this time, except a letter from two professors of Columbia and Harvard Universities. One will be here to-morrow and one the day following.

(The committee thereupon adjourned until to-morrow, Thursday, January 18, 1917, at 10.30 o'clock a. m.)

RADIO COMMUNICATION.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 18, 1917.

The committee met at 10.30 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. I would like to inquire who will have charge of the hearings on the part of those who are opposed to this legislation, so we can map out a program for the hearings. I have a letter from the Institute of Radio Engineers stating that Prof. M. I. Pupin, of Columbia University, and Dr. Kennelly, of Harvard University, and Prof. Goldsmith will be here. Prof. Pupin is here and wishes to be heard to-day.

Mr. GRIGGS. Prof. Pupin is here, and I think he would like to be heard first, if it is the pleasure of the committee to hear him.

STATEMENT OF PROF. M. I. PUPIN, PROFESSOR OF ELECTRO-MECHANICS OF COLUMBIA UNIVERSITY, NEW YORK.

The CHAIRMAN. Please give the stenographer your name and your profession or business.

Prof. PUPIN. M. I. Pupin, professor of electromechanics of Columbia University, New York; director of the Phoenix Research Laboratory in Physics of the same university; president of the Institute of Radio Engineers; president of the New York Academy of Sciences; member of the National Academy of Sciences; member of the National Advisory Committee for Aeronautics, established by act of Congress in 1915; member of the National Research Council, organized at the request of his excellency President Wilson, and so forth.

The CHAIRMAN. Are you interested in any of these companies?

Prof. PUPIN. No; I am not.

The CHAIRMAN. Financially?

Prof. PUPIN. I am not, and never have been.

The CHAIRMAN. In the Marconi, in the Federal, or in any other company interested in the manufacture of wireless apparatus?

Prof. PUPIN. I am not, and never have been.

The CHAIRMAN. You may proceed.

Prof. PUPIN. Mr. Chairman and members of this committee, I came here to testify for the purpose of demonstrating, if possible, that this bill would be most detrimental to the development of this young art—the wireless art—because it would inevitably lead to Government ownership of this wireless art. I look upon this wireless art as a very promising, healthy baby, which has a great future be-

fore it; a great future, provided this healthy, robust, and most promising baby receives the proper training and the proper bringing up. And the question, in my mind, is simply this: Who is to be responsible for the training and the bringing up of this wonderful baby? Its parents or a Government institution?

I am not a parent of the wireless art, but I am a very close blood relation to it, because I am the inventor of the electric tuning, the only means they have to-day to prevent interference between different stations receiving signals or transmitting signals at the same time. The art of electric tuning—I invented it and I sold the patents to the Marconi Wireless Co. of America in 1902.

I am also the inventor of the electrolytic detector, and I was the first to suggest the advisability of rectifying the received electrical oscillations. I suggested it before the American Physical Society in November, 1899, and showed the apparatus, namely, the electrolytic rectifier, by means of which the rectifying of receiving electric oscillations can be effected and was effected. This electrolytic rectifier was used for a long time as one of the methods of receiving wireless messages. It has been superseded by better apparatus, but the idea of rectifying the receiving of electric oscillations as a fundamental idea, and without which to-day wireless telegraphy would not be in the position in which it is, was mine. The rectification of the received electrical oscillations is one of the fundamental elements in the modern or recent developments of wireless telegraphy.

If I should appear to be blowing my own horn, you will pardon me. It is not my custom to do that, but on this occasion I wish to show to you, Mr. Chairman and members of the committee, that I am qualified to speak not only as an expert but as a close blood relation of this young wireless art, of this young art which promises magnificent results in the future; provided, however, that it receives the right kind of training and bringing up. I am anxious about this young baby on account of my blood relationship, not on account of my having any financial interest whatever in any of the wireless companies, because I have not. And if I had, I would not appear here to-day.

Now, it has been represented to you by the heads of our Government departments, namely, by the Secretary of War, the Secretary of the Navy, the Secretary of Commerce, Commander Todd, and by other Government officials interested in the national defense, that it is advisable and necessary, on account of national defense, that the Government should control, in fact, that the Government should own, wireless telegraphy. Now, I am interested in the national defense as much as anybody, and I am known to be interested in that, and for that reason was appointed as a member of the National Advisory Committee on Aeronautics, which is a Government institution. And for that reason, also, I have been appointed a member of the National Research Council and am a member of its executive board. The National Research Council, as I have already said, was organized by the National Academy of Sciences, a Government institution of which I am a member, at the request of President Wilson. And I am a member of it, appointed a member because they know that I am interested in the national defense as much as anybody. And I am convinced that if we are to use any art and particularly the wireless art for the national defense, the best thing for us to do is to develop

that art. If interferences exist, as has been pointed out in the several depositions here before you, on account of the present imperfection of the wireless art, then these interferences should be eliminated not by legislation but by perfection of the art.

Now, if you will be indulgent with me, I will illustrate that by describing as briefly as I can the experiences that we had, that the world had, in the development of other arts which are very closely related to the wireless art. Take the ordinary telegraphy and telephony by wires. What was their experience in their early history? Exactly the same as we have in the wireless art. From 1845 to 1860 the men interested in the development of telegraphy, electromagnetic telegraphy, invented by Joseph Henry and commercially developed by Morse—I say that between 1845 and 1860 the experts in electromagnetic telegraphy spent most of their time in quarreling among themselves on the subject of how to get around the inductive disturbances. They had inductive disturbances just as much as we have to-day in wireless telegraphy, and they were of two different kinds: Inductive disturbances produced in a wire by the operation of other wires and inductive disturbances produced by God. Now, those inductive disturbances produced by God have not been discussed in the depositions so far, but under certain conditions they are a great deal more serious than inductive disturbances in wireless telegraphy produced by man. And although it is possible—I do not say it is advisable, but it is possible—to get around the inductive disturbances produced by man through legislation, you can not get around inductive disturbances created by God by means of legislation, because God says, “My acts can be eliminated in the operations of man not by brute force (and that is what legislation in many cases is) but by intelligence.”

The CHAIRMAN. In other words, you do not think legislation is to be placed in the class of intelligence?

Prof. PUPIN. I do not say that.

The CHAIRMAN. That is the deduction, clearly.

Prof. PUPIN. I do not say that. I do not wish that inference to be drawn. But sometimes what we conceive as intelligence is not intelligence at all.

The CHAIRMAN. No.

Prof. PUPIN. Even in the wireless art they have tried to get around the disturbances created by God, inductive disturbances, by using an enormous generator. Now, that seems like an intelligent thing to do, but yet it is not. It is brute force; the man is trying to outdo God in applying force. That is brutal. We sometimes think that we are intelligently proceeding, when, as a matter of fact, we are not. We are simply proceeding in a brutal manner and erring, because erring is human.

But to go back to my story: Interferences produced by the acts of God can not be set aside by any legislation, and after all those interferences produced by the acts of God are much more serious in the present art of wireless telegraphy, just as they were much more serious in the early art of electromagnetic telegraphy, than interferences produced by the acts of man.

The CHAIRMAN. Define what those interferences produced by the acts of God are. We are not experts.

Prof. PUPIN. I will do that. Now, what are these interferences produced by the acts of God? We did not realize them until electro-telegraphy was invented. And we never realized it to such an extent as we do to-day, since the wireless telegraphy was invented. Now, what is wireless telegraphy? It is communication between two points on the surface of the earth, or between a point on the surface of the earth and a point in the air, as in the case of the aeroplane, by means of electric oscillations. You create an electric oscillation at the sending station; that electric oscillation goes to the receiving apparatus and creates there an electric oscillation which affects a receiving instrument.

We know to-day that these electrical oscillations are produced in the atmosphere by God for purposes that are known to Him. We can explain how they are produced, but we do not know yet what is the real intention of the Creator in producing them. They are called statics, and statics are the blackest enemy of the wireless stockholder. It is the statics which has prevented the wireless stockholder from reaping any benefit from his work. The wireless art is not quite yet, excepting in some of its features, a commercial art; in other words, it does not return dividends, principally because the statics prevent it—these disturbances, these electric waves that go up and produce in the air and all over and affect, in fact, every receiving instrument.

In April, 1914, when our bluejackets had landed in Vera Cruz, and it looked as if we were going to have a war with Mexico, I was here in Washington attending a meeting of the National Academy of Sciences. I happened to meet Dr. Austin, who is the director of the Wireless Research Laboratory of the Navy, and he told me that they could not force a message through between Arlington, or even Key West, and Vera Cruz; it was impossible. Why? Not because the Mexicans had a wireless apparatus which interfered with ours and not because anybody else had it, but because there the static was going on in the Gulf of Mexico and prevented our messages from reaching Vera Cruz. Interference in wireless telegraphy due to static, due to the acts of God, is so serious that sometimes a wireless station can not receive a message for 48 hours or even twice 48 hours. For days in succession they can not receive a thing. Not on account of interference of other stations but on account of the static, on account of the electric waves, the electric oscillations, which God sends from an infinite number of stations located anywhere in the atmosphere between the North and South Poles. Now, these are the acts of God, and I do not see that these interferences have even been touched upon in all of these depositions. And these are the most serious interferences that we have, and you can not get rid of those by any act of the legislature. The only way to get rid of those is by the perfection in the wireless art, by the proper training and bringing up and education of this healthy, robust baby, which I call the wireless art.

But the heads of the Government bureaus propose that this baby should be put into a Government institution, should be taken away from the loving arms of its parents and relations (and I am one of them) and put into a Government institutiton. Now, it seems to me that would be almost a crime to do it. We would suffer, the United States would suffer—the people of the United States; the Army and

Navy would suffer, because they would not have a beautiful and efficient art with which to defend themselves in time of war.

When it comes to getting rid of the acts of interference produced by the acts of man by legislation we can do that to a certain extent by legislation, providing we are legislating against the acts of our own citizens. But what legislation is going to prevent the enemy in time of war interfering with us. It is told by the English wireless operators who took part in the battle off Falkland Islands that the Germans, as soon as the battle started, went up and down the scale of their wireless sparks for the purpose of making it impossible for the English ships belonging to that squadron to communicate with each other. Now, I would like to know how any act of legislation, how any act of Government ownership, can prevent that. Of course, mind you, I am proceeding from the hypothesis that Government ownership is inefficient in the development of a new art.

The CHAIRMAN. Right at that point, pardon me: Would it help the situation any if citizens of our country, or wireless stations in our country, would intensify that condition of interference?

Prof. PUPIN. If I had my own way I should perhaps proceed in a radical way. I should produce as many interferences as I possibly could, for the purposes of development of the art so that no ingenuity of man could interfere with a wireless operator when he receives. And that is possible. Things are being done to-day by well-organized industrial research laboratories like the research laboratory of the Western Electric, the research laboratory of the General Electric, and the research laboratory of the Westinghouse Co.—things are being done to-day which will undoubtedly lead to wonderful results so far as preventing interferences produced by the acts of man are concerned. Things will be done. Things are within the reach of those who are studying the whole situation which will transform the whole aspect of the wireless art. Now, these things, I say, are being done because the Government does not own the wireless. And if the Government owned the wireless they would not be done. Why? I will tell you the reason why. I have the greatest respect for the Army and Navy. I have a great many friends among the officers of the Army and Navy. And I would not for the world do anything which would hurt their feelings. But we are here to be frank and open and aboveboard, and we must say what we think is right, what we think is best for the wireless art and for the people of the United States.

How does the inventor feel with regard to the Army, and particularly the Navy—I mean the wireless inventor? I will describe it briefly for the purpose of explaining what I mean when I say that if the Government owned the wireless the men who are interested in the development of wireless probably would drop out—drop their interest in the development of the wireless probably. I may be wrong, but that is really my opinion. I refer now to a man who made a very beautiful invention. In 1910 Dr. Austin, director of the Wireless Research Bureau of the Army and Navy, and whose station is on the grounds of the Bureau of Standards, published a paper in which he compared the efficiency of various types of receivers. Among the receivers he examined was a new receiver, the so-called audion, invented by Mr. De Forrest, the very audion receiver which is used to-day almost universally. Dr. Austin found

that this audion receiver was one and a half times as good as the best receiver they had prior to that time—one and a half times, mind you. At that time a young inventor, to whom I refer, was a student in Columbia University, a sophomore. That was in 1910. In 1912, when this student graduated, he got a patent—or I do not know whether he got a patent that year, but he had the invention anyhow, a very simple thing, consisting in taking that audion tube and by a simple transposition of the circuits, making that audion tube 5,000 times as sensitive as the one which Dr. Austin examined. Dr. Austin found it only one and a half times. This young student, by a simple transposition of circuits, made the same audion 5,000 times as sensitive. With what result? With the result that everybody is using it to-day and all the operating companies pay this young man a modest royalty. Not a very large royalty, because the operating companies are not making money—not much anyhow. They can not afford to pay more than a very modest royalty. But it enables this young man to support his mother and two sisters. The United States Navy uses this invention more than anybody else. According to the information which an officer of the Navy gave to myself, they were using it since January, 1914. And they had it at this time—and this was a year ago—in something like forty stations. They have not paid a cent to this young man, and they do not intend to. They all tell him, You can go to the Court of Claims.

The CHAIRMAN. Why?

Prof. PUPIN. I do not know.

The CHAIRMAN. Is anybody contesting his right to the invention?

Prof. PUPIN. The right has not been contested, and it is proved that it is not contested, because these wireless operating companies pay this young man a royalty, which is the best proof that an invention is valid; you can not have a better proof. The wireless operating companies know more about the art than anybody else. And if they did not have to pay the royalty, they would not pay it; but they are paying it. But the Government has never paid a cent, and probably never will until the Court of Claims decides in favor of this young man. Now, this young man is poor and he can not go to the Court of Claims. It costs money, and he can not afford it. His lawyer tells him, "You had better not go to the Court of Claims; you will spend a lot of money; you will spend everything you have, and God knows when you will get any return from it." And the result is that this young man has no other claim for his rights. Now, I am sorry to be compelled to testify to that effect. I am sorry to say this, but that has been the policy of the United States Navy. And I am afraid that if the United States Navy takes control over the wireless art that will be the policy still, unless the laws are very much amended. In other words, if this bill passes through, you will have to pass perhaps five, six, perhaps ten other bills for the purpose of protecting the inventor and protecting the art. That will be the result of it, in my opinion.

But laying that aside, brushing that aside with the argument that these things can be fixed up in such a way that the inventor will be protected and that he will be very anxious to work for the Government, offer to the Government his inventions and help in the development of the wireless art, I still maintain that the Government is not and never will be in a position to develop a new art. That must

be left to private enterprise and private initiative. Why? Well, it is a question of psychology, and there is no use arguing about that. It is a fact well understood everywhere that a new art is not developed and can not be developed by the Government. Even the German Government—yes, even the German Government—has not taken possession of the wireless art and will not take possession of the wireless art for some time to come. Why? Because the German Government understands that this is a young art, and should not be intrusted to the Government for its development—for its bringing up. It leaves it to private enterprise. Moreover, the German Government very wisely—and I am not pro-German, God knows—the German Government very wisely subsidizes private enterprise. It pays them so much a year to develop the wireless art. And I should say that if the United States Government is anxious to prepare this art for the national defense, the wisest thing for the United States Government would be to subsidize private enterprise to develop this art for the national defense as much as possible and as soon as possible. That would cost a great deal less—a great deal less—and give very much better results than Government ownership.

To go back again, after digressing somewhat, to the history of telegraphy, electromagnetic telegraphy and telephony: I said a little while ago that their experience was the same as the experience of wireless operators to-day. They had interferences from men and they had interferences from God. The inductive effects of one line upon another line were felt then. And if the United States Government at that time had decided to take the new art of electromagnetic telegraphy into Government ownership, because there were interferences between wires, they would have done probably this: No wire, telegraph wire, should be near another telegraph wire—nearer than, say, a mile or 2 miles. That would have been their way of overcoming those interferences, because that is the way they propose in this bill, that the wireless stations, you know, should not be placed except here and there, and the Government is to decide that. The heads of the departments are to decide that. The wireless engineers and the wireless experts and the men capable of building up the wireless art, they have nothing to say about it. It is the heads of the Government departments.

Now, if that policy had been pursued in 1845 and 1846, up to 1860, we would have been compelled to place the telegraph wires at a distance, say, of a mile apart or perhaps 10 miles. And you can easily imagine what would have become of interferences then, as far as the acts of man are concerned, and what would have become of interferences then as far as the acts of God are concerned, because the statics in electromagnetic telegraphy would have been just as bad, and no matter how far apart the wires are from each other. But that was not done, thank God! The inventive genius of the American mind and American enterprise went on and solved this problem in a most satisfactory way by the Wheatstone automatic system. The Wheatstone automatic system enabled the wires to be placed right alongside of each other, if you please, within 18 inches. So that you can have any number of wires on a one-pole line to-day. That means a tremendous saving in expense of installation of telegraph lines.

It was found in the early history of telephony, from 1876 on, that we had cross talk between telephone wires; you would be talking on one wire and another man talking on another wire, and you could hear each other's conversation; and if 10 wires were near by you would hear 10 persons at once talking to each other, owing to the inductive interferences.

It has been testified in this case by Government officials that wireless telegraphy is different from other methods of electric signaling, because they use the same medium, the air, the ether, whereas in telegraphy and telephony they do not but each man has his own circuit. Well, a school boy, a sophomore at Columbia University, knows that that statement is absolutely incorrect. There is nothing in it. They do not use the same medium in wireless telegraphy any more, nor any less than they do in ordinary telegraphy and ordinary telephony. It is very true that in ordinary telegraphy and ordinary telephony you have one wire so that as far as the motion of electricity is concerned you have only one path. But the electric force is not the only force used in signaling; there is magnetic force. In fact, it is the magnetic force that enables us to set our detecting apparatus into motion and not electric force. It is magnetic force with which they operate. Now, as I said, every schoolboy knows about that. But, as far as magnetic force is concerned, we use the same medium in ordinary telephony and ordinary telegraphy as we use in wireless. They all use the atmosphere; they all use the infinite medium. The same medium serves the telephone, the telegraph, and the wireless. They all use the same medium for the ordinary transmission of the magnetic force. And there is no distinction between the two methods at all. And for that reason, as far as interference by the acts of man and the acts of God are concerned, both had the same difficulties, both had to go through the same history of development—the electro-magnetic telegraph and the electromagnetic telephone.

Now, in the electromagnetic telephone, we had interference between wires. We had cross talk, so that you could hear any number of people at once interfering with other people. And if the Government had owned the telephone wires, they would have simply legislated and would have determined that no telephone wires can be placed at a distance closer, say, than a hundred yards. This would have given a black eye to the development of the telephone art. To-day we use a cable with a sheathing, say, of four inches in diameter, and we place inside of that sheathing 600 definite circuits, and we can have 600 different people talking at the same time through these circuits without any cross talk; without any interference at all, whereas if the Government had owned that art from 1876 to 1895, or 1900, we would have had to separate those wires and the art would have never reached that point where it can have in a small space 600 different circuits; it would have been impossible.

The CHAIRMAN. You think that would have arrested the development of the art?

Prof. PUPIN. I think that would have arrested the development of the art.

The CHAIRMAN. Inventors would not have undertaken to overcome that difficulty, to bring the wires together and have the six hundred and odd wires in the same cable?

Prof. PUPIN. No; they would not. What is the use?

The CHAIRMAN. That is your assumption?

Prof. PUPIN. What is the use of doing it, when the legislature has passed a law that these wires should not be placed close together, which would interfere with each other?

The CHAIRMAN. Until the art would permit it, would not that be all right?

Prof. PUPIN. What is the need of developing the art, if these interferences do not exist? You have in this bill that a station shall not be closer than so and so; that the wave lengths should be determined by the Government for the purpose of eliminating these interferences. Now, if you eliminate them in that way, then the interferences do not exist and what is the use of developing the art? Where is the incentive to the inventor?

The CHAIRMAN. It would come in any event. Why didn't they just continue that way? How did it happen it was ever developed?

Prof. PUPIN. How did it happen?

The CHAIRMAN. Yes.

Prof. PUPIN. If you will permit me, I will tell you.

The CHAIRMAN. The Government is the most generous purchaser, and pays the largest price.

Prof. PUPIN. To whom?

The CHAIRMAN. To the inventor.

Prof. PUPIN. When? A lieutenant in the Navy told me to my face that the Government never paid any inventor more than \$7,000 for an invention. I received from the American Telephone & Telegraph Co.—well, I won't say; but certainly not \$7,000, but probably seven hundred times that. Where is the incentive for the inventor?

The CHAIRMAN. I guess the Government is paying that company now a good royalty on what they paid you.

Prof. PUPIN. The invention is worth to the company a hundred, perhaps a thousand, times as much as they paid me. Certainly a hundred times. And it is worth to the people of the United States a hundred times as much as it is worth to the company. It is the people of the United States who profit by it. We can telephone today, Mr. Chairman, from any point in the United States to any other point in the United States. You can be on a ranch in Texas or Arizona and telephone to the Waldorf Astoria at any time—at any time of the day or night. You can call up anybody in the United States. Why, you can not only talk to one man, but you can talk to an audience of a thousand hearers in the Waldorf Astoria. I was one of an audience of 2,500 people in the Symphony Hall, of Boston, last June when the voice in San Francisco was heard by every one of the 2,500 hearers. I candidly and openly confess that if the telephone had been in Government ownership, we should never have reached that point; never. Why haven't they reached that point in France or England?

The CHAIRMAN. Who was the inventor of that process by which that was possible?

Prof. PUPIN. I was the inventor.

The CHAIRMAN. By which you can magnify the voice, you say?

Prof. PUPIN. No; by which you can preserve the character of the speech. When you preserve the character of the speech that has been

transmitted any distance, like from San Francisco to New York—if you preserve it, so that it is not distorted—then you can easily magnify it to any amount you please. That was the invention of somebody else. That was a recent invention. Whose invention was that? Let me say De Forest invented that, if you please, because he was the first to suggest the vacuum tube, which was developed by the American Telephone & Telegraph Co., and by the General Electric Co., which has been interested in the wireless art, too.

The CHAIRMAN. I believe he will be here at the hearings.

Prof. PUPIN. Mr. De Forest?

The CHAIRMAN. Yes.

Prof. PUPIN. Now, he was the first to suggest the so-called audion. I was invited to discuss his paper when he first read it. I think it was in 1906—10 or 11 years ago. The paper was read before the American Institute of Electrical Engineers, and the committee on papers of that institute invited me to be present and open the discussion on the paper. They sent me an advance proof of the paper, so that I could study it and open the discussion. I studied the paper; I saw that there was a novel instrument, something entirely new, and I said that this will undoubtedly lead to great advances in the art of electric communication—electric telegraph, telephone, and wireless. I thought very highly of it and said so. The inventor himself did not have, nor did I, quite a clear idea of the full value of this new piece of apparatus. But I thought very highly of it, because on account of its radical novelty. And I said to my friend, J. J. Carty, the chief engineer of the American Telephone & Telegraph Co., "Carty, here is something new; here is something that you never dreamt of. Who knows but that some day you may get out of this new piece of apparatus a telephone relay? Take it up; see what you people can do to develop it," because De Forest himself, although a clever man, did not have any laboratory facilities needed for the development of such a new thing.

The result of that was this, that the American Telephone & Telegraph Co. bought a license, bought the rights from Mr. De Forest and from Mr. Peter Cooper Hewett, who is another man who worked in the same direction. They bought their rights; and they started the development work, with the result that owing to the excellence of their research laboratory, owing to the excellence of the men they employ—a generous, rich corporation—they are a very big corporation and they employ the best men they can get, and the best men are very glad to go to work for them, because if they do well there their future is secure—they developed the amplifier which they employ in telephony, and which to-day is also really of the greatest importance in the wireless art, and is used by the United States Navy with tremendous effect. And I am glad of it, and will always be glad of it. The United States Navy to-day would not have an establishment, would not have a wireless station so efficient, although it is not perfect yet; but, as efficient as it is, if it had not been for the development work of the Western Electric Co., which is the American Telephone & Telegraph Co., and the General Electric Co.'s development work on that tube.

Now, if the Government means to take possession of the wireless art and establish industrial research laboratories and go into the

art of manufacture—because that is the only way that you can develop an art—to manufacture yourself and not have somebody else manufacture it for you—then well and good. Then perhaps this bill would have some meaning. But this bill as it stands, with the other conditions—with the other laws existing and the other historical conditions of Government work existing—this bill means nothing else than a blow to this wonderful art of wireless telegraphy.

The CHAIRMAN. Do you understand that this bill—I presume you have read it?

Prof. PUPIN. I have read it.

The CHAIRMAN. It does not provide for Government ownership. There is an amendment suggested to that effect.

Prof. PUPIN. It does not provide for Government ownership but inevitably leads to it, and the Secretary of War (Mr. Baker) and the Secretary of the Navy and Commander Todd—they all say that it will lead to, and they want it to lead to, Government ownership.

The CHAIRMAN. They are in favor of Government ownership, and they have proposed an amendment to the bill providing for Government ownership; but there is nothing in the bill that provides for it.

Prof. PUPIN. Mr. Chairman, I beg to disagree with you, because I can not read anything else in this provision, sections 5 and 6, than that it does mean Government ownership; and if it does not mean Government ownership I do not know what it means. Sections 5 and 6 I can not understand to mean anything else than Government ownership. And section 20 and other sections which refer to regulation by the Government, if the Government is going to impose arbitrary rules upon wireless operators, upon private enterprise operating wireless stations, why that control will kill the art, even without ownership. If we are to control the transmission and reception of wireless signals I believe the Government should do it, but I believe the Government should do it in conjunction with well-known recognized electrical authorities—wireless authorities. Let them together devise a method of preventing interference. The patriotism of this country is not all centered in the Army and Navy and the administration. There is some patriotism in the rest of us who are not in the Government service, and we will do our best to prevent interference with the operations of the Army and the Navy—do our best. And we will do it for the same motives that the Government has, namely, pure and simple patriotism. But don't let the Government, independent of anybody else, prescribe rules of operation so as to avoid interference. This thing can be done and would be done and should be done.

The CHAIRMAN. I suppose that is what you are here for—to suggest how it could be done.

Prof. PUPIN. We could do it.

The CHAIRMAN. There should be regulation, you think?

Prof. PUPIN. There should be regulation; yes.

The CHAIRMAN. That is what we would like to know. If you do not agree to the method suggested by the Government, the committee, I am sure, would like to know what you suggest. You agree it is necessary.

Prof. PUPIN. I suggest the same thing the Government has done in the case of aeronautics. The Government has appointed a committee of 12, the so-called National Advisory Committee for Aeronautics.

It is a committee, I believe, of 12. I am a member of it. There are four Army and Navy men, two from the Army and two from the Navy; four from the Government bureaus, and four from the universities—Johns Hopkins University, the Columbia University, the Leland Stanford University, and the Northwestern University. I represent Columbia University. Now, with 12 men—four civilians, four Government officials, and four Army and Navy officers—we are getting along beautifully, and we are fixing up the aeronautic arrangements for the Army and Navy in a most friendly and successful way. We have done a lot of work. We are doing the work, and everybody is just as loyal to it as the Army and Navy men are, and I am sure in a short while we will have accomplished great things. And the Government has perfect confidence in it. Let us have the same thing for wireless; let us have four Army and Navy men, four Government officials, and four university men. And I think it would be all right to have some men representing operating companies. Let us have a committee, and let that committee meet once a month, as the other committee meets, through arrangements made by its executive board, and go over the field carefully and advise the Government what should be done. A committee of that kind would do wonders—wonders. And whatever they decided to do, it would be a decision not of the Army and the Navy alone, of the Government officials alone, but the Army and the Navy and the Government officials, together with the universities and the operating companies. Certainly advice of that kind would be acceptable to everybody, and I think it can be done and should be done, and we will have magnificent results. I could almost guarantee them, if my guaranty was worth anything.

That is the way to do it, in my opinion, and not by legislation.

Mr. HARDY. Wouldn't you need legislation to enforce the rules of the committee as against extraneous or outside parties?

Prof. PUPIN. Oh, yes; but that legislation would be recommended by this national committee for the wireless.

Mr. HARDY. After all, you get back to the need of legislation?

Prof. PUPIN. Oh, yes; legislation to be sure; but not one-sided legislation; not legislation that would hurt the art. Because this committee, if it is a good committee, and it will be—we have good men everywhere, in the Army and Navy and the Government service, and in all the universities and operating companies—will recommend legislation that will not hurt the art.

Mr. HARDY. Do you think that committee could possibly devise a conclusion, a harmonious set of rules, that would not have just about as much opposition to it from somebody of different opinions as this bill?

Prof. PUPIN. Yes; I think they could.

Mr. HARDY. You will admit it would be a wonderful committee if they could reach conclusions which were not criticised?

Prof. PUPIN. Oh, but they will be criticised. There is no bill that anybody could frame that would not be criticised.

Mr. HARDY. And wouldn't we be sitting right here like we are now, with hundreds of witnesses coming in and criticising your rules when you got them formulated, and objecting to them?

Prof. PUPIN. They would slightly object to them, yes; but they would not have very good arguments.

The CHAIRMAN. That is what we are here for, to hear arguments pro and con on this bill.

Prof. PUPIN. They would not have very good arguments.

Mr. HARDY. I was just wondering whether you couldn't get something on which there would be a unanimity of opinion?

Prof. PUPIN. You will never get a unanimity of opinion among the people of the United States. It is quite impossible; you can not do it, and it has never been done yet. You can not have a unanimous opinion. But among the members of well-trained, intelligent, patriotic committee—I will say like the advisory committee for aeronautics, the National Advisory Committee on Aeronautics, we have had some unanimous decisions. They were good. They were for the good of the aeronautic art of the United States. The President thinks well of them, the Government thinks well of them, and the Army and Navy think well of them, and the House of Representatives thinks well of them, because they have given us appropriations. That is the best proof of what they think.

Mr. HARDY. Oh, as long as there is no conflict of interest in your committee, you can get harmonious action; but when you do get a conflict of interest between you, or your environments change, then your committee is going to bust up in some conflict.

Prof. PUPIN. Yes; that is very true if we have any conflicting interests; but I know we had a meeting at the Smithsonian last May between the members of this committee and the manufacturers. The question arose of how to get a first class, large-power motor for the Army and the Navy for flying machines—for aeroplanes. You know at that time we had the Mexican trouble, or we were looking ahead and seeing that probably we were going to have trouble there. And we had no aeroplanes that could fly very high in that rarefied atmosphere of Mexico, because we did not have high-power motors. And the Navy men, like Capt. Bristow, told us that he had tried his very best to get a good motor over 100 horsepower, if possible 200 horsepower, with no success. Now, he said, what shall we do? It was suggested that we should have a meeting between the executive board of this National Advisory Committee for Aeronautics and the representatives of the manufacturers. They came and we had a meeting at the Smithsonian under the presiding chairman, Mr. Walcott, the Secretary of the Smithsonian. Well, you may say that if there ever was a meeting of men where there were conflicting interests it was at that meeting; because we had something like 14 or 15 manufacturers, one advocating one type of motor, the other man advocating another type of motor, and so forth. And yet when the thing was presented to them in the right light—that we should, for patriotic reasons, brush aside all of our personal likes or dislikes and personal interests, you know you never saw such a meeting. Unanimous; perfect unanimity of opinion. I never attended a meeting in my life where everybody was trying to do his very best as in that meeting. And we did succeed in getting some of the manufacturers, notably Mr. Algiers, of the Packard Co., who is a rich man and who does not care whether he spends \$200,000 or not in the development of a motor—he told me personally “I will spend \$200,000 to develop a motor satisfactory to the Army and Navy, and I do not care whether I get a cent of that back or not.” That was the result of that meeting.

Mr. HARDY. I can readily see how all the rest of you could harmonize on that.

Prof. PUPIN. Well, I only mention that to illustrate what was the motive, the moving spirit of that meeting. It was patriotism. And so it is in wireless telegraphy. When it comes to regulating the wireless art for the purpose of avoiding interference with the operations of the Army and Navy we will have one motive in every member of that committee, the motive of patriotism, which will sweep everything else aside. And we will have decisions that will actually help the Government. I am just as sure of that as I can be. They will help the Army and the Navy. We want to help the Army and the Navy. We do not want to interfere with them. Every scientific man to-day wants to have the best Army and the best Navy in the world, and he will do everything he can to help the Army and the Navy.

Mr. GREENE. The statement you made about the young man who made the invention that the Navy is using without paying anything for it and not proposing to pay anything for it—I would like to know what that represents here. As I understand you, that represents an exhibition of brute force, does it not?

Prof. PUPIN. No; I did not refer to that as an exhibition of brute force.

Mr. GREENE. I should call it that, because we have the power to prevent him from getting anything for it without putting him to an expense that no ordinary man can go to. That is what the Government does; it sets itself up to deprive a young man who has originated something in his brain, which God gave him—he has originated something in his brain that is of value to the Navy.

Prof. PUPIN. Yes.

Mr. GREENE. And then they throw obstructions in the way of his being paid for it, while private individuals engaged in the same line encourage the young man and pay him a royalty.

Prof. PUPIN. They pay him a royalty; yes.

Mr. GREENE. But the Navy has never recognized him or made any effort to remunerate him or made any recommendation?

Prof. PUPIN. No; not to my knowledge. The young man will be here to-morrow or the next day and will testify in his own behalf.

Mr. HARDY. Hasn't he a right to sue the Government if the Government infringes his patent?

Prof. PUPIN. He has a right to sue the Government, but he is not able to establish his rights, to win his rights, because he has to hire a lawyer and go into the Court of Claims, and he has not the money to hire a lawyer.

Mr. HARDY. Don't everybody else have to hire a lawyer when they sue the Government?

Prof. PUPIN. That is very true. I was speaking, you know, of how Government ownership—

Mr. HARDY. You do not think, though, Professor, it is unreasonable for the Government, if it disputes a claim, to require that it should be established—if that is the case? I do not know anything about the facts of the case.

Prof. PUPIN. But why should the Government dispute his claim when the private companies are paying a royalty and they do not dispute it?

The CHAIRMAN. Is the Government the only party disputing his claim?

Prof. PUPIN. As far as I know, it is the only corporation or organization that disputes his claim. I do not know that they dispute it, but simply do not pay him anything for it.

Mr. GREENE. They take it by main force.

The CHAIRMAN. I do not think there is anything that would bear out that statement for a minute. I do not impeach the Government in that way without a knowledge of the facts.

Prof. PUPIN. I do not impeach the Government; I only say what they can do and do do.

The CHAIRMAN. It is tantamount to saying the Government, that is, the officials of the Navy, are committing an injustice to this young man and holding him up without any sense of justice. Do you mean to say that?

Prof. PUPIN. No, sir.

The CHAIRMAN. Do you know the facts of the case?

Prof. PUPIN. I know the facts of the case.

The CHAIRMAN. Do you know why the Government does not pay him?

Prof. PUPIN. They simply don't pay him; that is all.

The CHAIRMAN. Do you know why they do not pay him?

Prof. PUPIN. I do not know the reason why.

The CHAIRMAN. Do you know why the Government has said, you must go to the Court of Claims and establish your right to this invention before the department will be authorized to pay you a royalty on your invention?

Prof. PUPIN. I have been told; yes. I have been told that somebody told them that this invention does not belong to this young man, and that they are not in a position to sit down and decide in patent matters, but they would rather have the Court of Claims decide that. And all along, you know, the other organizations, private organizations, operating companies, and wireless companies are paying this man a royalty.

The CHAIRMAN. My attitude is simply this, that I will reserve my opinion until I know the facts.

Prof. PUPIN. The young man will present them before you. He will appear before you and give you the facts. I only referred to that for the sake of illustrating their policy.

Mr. HARDY. After all, your position comes down to this, that the Government has notified this young man there are other claimants to the patent, and they can not decide the matter; and they have asked him to get the Court of Claims to decide it?

Prof. PUPIN. Yes.

Mr. HARDY. And do you see anything radically wrong and abusive in that?

Prof. PUPIN. I am not here to dictate etiquette, the rules of etiquette and morals of the Navy. I am only using it to illustrate my point.

Mr. HARDY. But I am asking you from your point of view if the Government in saying this, and there are conflicting claims—do you find any moral wrong in their suggesting to this young man or tell-

ing him to "go to the Court of Claims and establish your superiority to your claim, and we will pay you"?

Prof. PUPIN. I think there is something wrong there—yes, for this reason: I have told the Government who this young man is; I told the Government that this young man is a poor young man, and that he supports an old mother and two sisters, and that they should be generous.

Mr. HARDY. Now, professor, I want to call your attention to the fact that the officers of the Government have no right to be generous to your friend. It is their business to pay for nothing except where a title is perfect.

Prof. PUPIN. Not generous in that sense.

Mr. HARDY. How did you use the word?

Prof. PUPIN. To give him the benefit of the doubt.

Mr. HARDY. They have no right to pay for a questionable title. Now, then, I call your attention to another thing: Your young man, you say, is now getting royalties from a number of private companies which enable him to take care of his family?

Prof. PUPIN. That has happened since.

Mr. HARDY. And yet you say he is not able to bring suit, to get some other young man, a young lawyer, and to pay him a reasonable fee to present his case?

Prof. PUPIN. No.

Mr. HARDY. Do you think it would take a fortune to present that case to the Court of Claims?

Prof. PUPIN. So the lawyer says. The lawyer made this statement: It will take everything you have to present that suit, and sometime in the distant future you may get something.

Mr. HARDY. Then you must apprehend there is a whole lot of opposition which will develop when you go to the court to present that suit, else it would not be so expensive, would it?

Prof. PUPIN. No; I do not infer that.

Mr. HARDY. Where would the expense be if it was plain and easy sailing to establish his claim, if there was no question of his right?

Prof. PUPIN. Well, I was sued once for robbery.

Mr. HARDY. For what?

Mr. PUPIN. For robbery.

Mr. HARDY. Well, you do not look it.

Prof. PUPIN. Well, I was sued, and it cost me a thousand dollars to defend myself.

Mr. HARDY. A thousand dollars?

Prof. PUPIN. A thousand dollars; yes.

Mr. HARDY. I thought this thing was going to cost that young man several hundred thousand to bring a suit?

Prof. PUPIN. A thousand dollars to that young man is like several hundred thousand to some one else.

Mr. HARDY. The young man is drawing royalties from wireless companies—

Prof. PUPIN. But the wireless companies are only paying meager royalties, because they are not making much money.

The CHAIRMAN. We will develop the facts about that later on.

Mr. EDMONDS. If you went before the Court of Claims, you would have to produce experts and everything else like that?

Prof. PUPIN. We would have to produce experts, and an expert costs more than a lawyer.

Mr. EDMONDS. Yes; I paid one \$60,000 at one time.

Mr. HARDY. I would have done without an expert if he had cost me \$60,000.

Mr. EDMONDS. But the other fellows were offering him as much, and I had to do better. He was willing to go on either side.

Mr. HARDY. I do not think his testimony would be worth much in that event.

STATEMENT OF HON. JOHN W. GRIGGS, REPRESENTING THE MARCONI CO. OF AMERICA.

Mr. GRIGGS. Mr. Chairman and gentlemen of the committee, I represent the Marconi Wireless Co. of America. I am the president of it, and I have been an officer and director in the company since 1902. The name of the company signifies its connection with the Marconi inventions.

It is about 20 years ago, since Mr. Marconi, who is an Italian subject, started the practical development of this radiation in the ether, which has developed into the system by which we can now read wireless signals. Mr. Marconi's inventions were patented in the United States, the same as they were patented in Great Britain and all other European countries, and a company was formed in Great Britain called the Marconi Wireless Telegraph (Ltd.), and the coordinating company, that I now represent, was formed in this country for the purpose of developing to a point of profitable utility this new discovery and invention. Mr. Marconi got for his American patents stock in the company. He got no money, and he never has from the American company. In addition to the stock, which they issued for patents, the public has subscribed for and taken about \$7,000,000 of the cash capital at par, which is the money contributed to the American Marconi Co., its total capital being \$10,000,000.

At the present time the American company has about 22,000 stockholders, of which 18,000 are residents of the United States. Mr. Marconi has been an honorary vice president during the existence of the company, but he has never taken any part in the management of the company, which is an American corporation.

Now, from the beginning of the Marconi Co., it began to expend money to develop the art to a state of profitableness as well as public usefulness. It built stations at various points, which stations have since been scrapped because better methods have been devised, better apparatus invented. All carried out the main, fundamental invention of Mr. Marconi. That his was the fundamental invention is recognized by all the scientific bodies of the world. He has had honors bestowed upon him by his own country and has been the recipient of the Nobel Prize for his work of invention in the wireless art.

For 15 or 16 years this company has been operating to develop this art and this business for the purpose of making a profit for the investors—the stockholders. It has developed what is known as the ship to shore business, so that in connection with its manufacturing of apparatus which is carried on at its factory, it is making at the present time a trifling profit over and above its ex-

penses but not enough to justify a dividend upon its stock. What it does is this: It manufactures apparatus of small capacity and leases it to ships of American registry that trade on the high seas, furnishes the ship with the operator, and gets a monthly rental for that. The law of Congress requires the ships to be equipped with wireless apparatus, and I think almost all of the American fleet on the Atlantic coast is equipped with Marconi apparatus. In order to render this apparatus more valuable to the lessees, the wireless company has instituted and established coastal stations at various points from Maine to Texas. Now, these coastal stations serve not only as points of communication with ships going up and down the coast and in order to transmit intelligence to or receive intelligence from the mainland; but they also serve as supply depots for the Marconi Co.; and the lessees of the apparatus, when they sign a contract, are assured by our company that with these stations at designated points along the coast, at any time they put into the ports where these stations are located, they can get any new parts for their apparatus which they may need, or they can get their apparatus repaired by one of our experts who is there on the ground for that purpose. Or if their operator has been disabled, has died, or from any other reason is disqualified, we can furnish them with another operator. So you see that the system of coastal communication stations, while there has been some suggestion here that they did not do a toll business with the ships that paid, is as indispensable to our plan of doing business as is any part of the plan. And I may say right here, now, that if the Navy Department was allowed to alone carry on these coastal stations, they would not be able to provide supplies, make the repairs, and furnish the additional operators which the Marconi Co. does and which it is a part of our contract to give the lessees, of which I think there are now about 500 sailing the Atlantic from one port to another.

In addition to this development of the ship-to-shore business, in connection with the legislation that requires it, the ultimate large purpose of the company from the beginning has been to establish trans-Atlantic communication in competition with the cable lines for the benefit not of the military department of the Government, but for the benefit of the commercial people of the United States—not to the exclusion of the Government, but for its benefit as well as for the larger benefit of business and commerce of the American people. Now, it took a long period of experimentation; it took a long period of preparation and construction to reach that point where we were ready to do that business. The company has expended nearly \$5,000,000 in the construction of stations on American soil prepared to carry on the transoceanic business with foreign countries. The principal stations are in New Jersey, known as the Belmar receiving and the New Brunswick sending stations, because in the development of the art it was found necessary to have two stations, one to receive and the other to transmit. And that station was built to correspond with the Marconi station in Great Britain, under a traffic arrangement made with the British company. The American station was built and paid for by American money; the English station was built and paid for by English money.

In addition to that, we built in California a large expensive station, receiving and sending, to connect with the Hawaiian Islands;

and in the Hawaiian Islands we built two large and expensive stations to connect with Japan. And to-day we are carrying on the sending and receiving of messages between Japan and the United States, by way of the Hawaiian Islands, by the Marconi stations.

And besides that we built on Cape Cod a pair of stations in connection with Norway, to coordinate with the Norwegian station.

Just as we were ready to start the trans-Atlantic business the war broke out. The British Government [which, contrary to the opinion expressed by some gentlemen here, does not operate the wireless exclusively through the post-office department, but only to a small degree through the post-office department and not to the exclusion of the private companies] took over the Marconi system in Wales, which was, by contract, bound to coordinate and do business with our station at Belmar and New Brunswick, and put it in the charge of the admiralty and has since been using it for war purposes in connection with various European countries with which it wishes to communicate. And, of course, we have not been able to do any business with that country. For the same reason the construction of the Norway station, which was contracted to a British company was stopped by the British Government, because it wanted all the wireless apparatus which could be made in the Kingdom for itself.

And what was the object and effect of all this? An Atlantic cable cost at the old prices, \$7,000,000 to lay, and it had to be kept in repair. Those wireless stations cost \$2,000,000. We proposed, and we were doing it wherever we had the opportunity and we have done it between San Francisco and Hawaii, to reduce the rate of communications between these foreign countries. We proposed to compete with the prices of the cable companies and we have reduced the cost where we have gone into business, one-third below the cable rates. Is that a benefit to the public, or not? Is competition of this kind a thing which ought to be favored by Congress, or which ought to be disregarded? Now, we claim we are the direct competitors for this great commercial business with the ocean cables. And we propose, if we are allowed to go on and live, to give the public the great benefit that comes not only from having two means of communication, but having competing lines of communication whereby rates will be lowered.

Now, what good has the Marconi Co. done for the world since it was organized? Read the list, an enormous long list, of lives that have been saved from sinking ships at sea. The benefits to mankind and to the world, in saving property and life, of the Marconi Co. are enough for the Government, if it had a right to recognize those things, to give it an enormous bounty. And yet it has had nothing in the way of profit. And why do people invest in a stock company, in a new enterprise like this, similar in its character to the Bell telephone? Is it not because after years of preparation they expect to see a time come when they will reap a profit for their long waiting? And that is the position of the stockholders of the Marconi Co. They have reached a position where, prior to the European war, they could see before them great profits, and where in the ship-to-shore business they are already reaping a measurable profit from a by-product, as we call it. That being the case, and there being on the statute books a law that you gentlemen thought was adequate, Mr. Chair-

man, when you passed it in 1912, a law to regulate this business, and there being an international treaty between this country and all the other countries that use wireless, which was thought necessary and proper to regulate this business—now come in the Navy Department, principally, with this new proposition.

Let us see just what it is and what the effect of it is to be on the Marconi Co., and whether it is wise, whether it is necessary, and whether it is just. It has been admitted here by Commander Todd and Capt. Bullard—admitted, as I have read the statements here—that the object of this bill is to coerce the Marconi Co. into letting go of its business, particularly its coastal stations. The proposition is to give the Navy Department unlimited authority to do commercial business in competition with these gentlemen who have put their money into a mercantile venture, and to so conduct the Government end of it that eventually, in five years, we would be glad to sell out. Now, I am not making that charge against the Navy; that is what they say their purpose is. I do not characterize it at all; I leave it just as it is, and all I say about it is that it is not a just way for Congress to treat a great beneficent commercial enterprise. Notice. I say beneficent. Not only has this enterprise and this company done good to the world, but nobody comes with any charge against it of monopoly and oppression and misconduct. It is a clean-cut, decent, commendable enterprise. But it is the purpose of the Navy Department, if they can get this bill through, to treat it that way.

Now, let me see what further they purpose to do. They purpose to give the President of the United States the power to seize any one of our stations, long distance or any other, at any time, whether this country is at war or not, but there happens to be a war somewhere else on the face of the earth. When did Congress ever make such a law as that? That would be a condition that would exist any time. And, with the object which these gentlemen from the Navy Department have disclosed, what confidence would the stockholders have in the security of their investment? Oh, but they say, this is to be done by making compensation. If the Government takes your station they are going to make compensation. Well, now, Mr. Chairman and gentlemen, when this country is at war, or when it is in an emergency, the present law authorizes the President to take over and operate our stations. And this company is patriotic enough to concur, nay, to offer that privilege to the Government. It has done so in communications that are on file. It has said to this Government, "Whenever this country is at war you can have our men sworn into the Government's service. We will tender them to you. You can take our stations, and we will wait for our compensation, like loyal citizens, until you can make it. We won't demand it in advance." Just as the English company is now waiting for Great Britain to compensate them for the use and possession of their stations for these two and a half years. But when there is not any war, when some naval officer has an idea that he would like to control and operate the long-distance station for some purpose of investigation or experiment in connection with his fleet, instead of coming to the company and asking them to cooperate, the President seizes it and makes just compensation. What is just compensation? It has been pointed out here on questions raised by members of this committee that this bill does not provide any way of determining the value of the property you propose

to take from these wireless companies. If you provide no appropriation, if you provide no method, what does the law say? It simply says that when the Government takes the property of a citizen for public uses a claim arises on behalf of the owner, which you may prosecute in the Court of Claims. In other words, you take our stations and operate them for five months and break up and ruin our business, and you have given us in return a lawsuit. Now, you gentlemen are lawyers and you know that a lawsuit is not considered equivalent to a certified check or a warrant on the Treasury. And, yet, all through this bill is the power to take and no provision to pay. And, worse than that, if we went to the Court of Claims after the Government had seized our stations and ruined our company, what could we demand? Could we demand anything except the mere material value of our stations?

Now, gentlemen, I want you to think of this. This is an American commercial enterprise, entered upon in good faith, with good money behind it, reached almost to the point of satisfactory profits. And now you are asked to pass a bill under which the Government, directly or indirectly, can force us to let the Government take our property, and you are providing a method by which we can go to the Court of Claims, and, at the tail end of a judgment, then ask Congress for an appropriation to pay the judgment, and get what? Merely the material value of our station. Is that just? Is that just treatment of those stockholders who have put their money in and developed this business and developed this art until it has attained its present dimensions and present great degree of usefulness?

What is to be done? Why, when they have appraised the value of these stations, with proper depreciation for wear and tear, and have paid two or three millions of dollars, or five millions of dollars, into our treasuries and the business of the company is gone, we can declare a dividend among our stockholders. We always have money enough to pay our debts, thank Heaven, and we can divide up what is left with the stockholders, and they can go off with 40 cents on the dollar, or 50. But, they ask, "where is the balance we paid into this company?" "Why, we spent it in getting it in shape for the Government to take it over at the cost of the material which we had on hand at the present time." And do you think that the answer to that suggestion will be complimentary to the bill that enforced that result?

That that is in contemplation appears from the evidence that has been brought out before this committee. Commander Todd, I think, and some of the others said, "Why we estimate we can get all of these stations, long distance and all of them, now at an appraisement of \$5,000,000. But if you wait a few years they will be worth twenty." Why will they be worth twenty million, gentlemen? Because of the appreciation of the material? No; but because the company will have realized its hope and expectation in bringing these stations to an earning point. And then if the company attempted to tear them down when they were showing an earning capacity on \$20,000,000 the very stones would cry out in protest against it.

Now I ask, gentlemen, whether a provision, a bill, which threatens so directly as this the welfare and the continuance of these com-

panies in these vital respects—whether such a bill is a wise one, or not.

Regulate the business? Aye. We have always stood for regulation and we have obeyed to the letter the regulations of the Department of Commerce, which I must say, have been administered with justness and fairness to the wireless companies and the Government, too. We have no complaint to make of that department. But of the Navy Department we can not give the same complimentary assurance. Something was said about the attitude of the Navy Department towards patented inventions. I would like to tell you something that I know. The Marconi Co. found that a small manufacturer had bid to the Navy Department for the construction of some apparatus which infringed the adjudicated patents of the Marconi Co. It filed a bill for injunction against this would-be contractor, and the Navy Department intervened with a letter, in which they said that those were needed for the Navy Department and they did not want any injunction. They did not say there was any dispute about the ownership of the patent rights; they said they wanted them in their business. Whereupon Judge Hough, the United States district court in New York, held that where the Government wanted material like that he would not enjoin the contractor, but he would leave the patentee and the complainant to his remedy by a suit in the Court of Claims. Now, in that case it was admitted in the record, by the contractor for the Navy Department, that he was selling infringements on an American patent. He did not deny it. For the purpose of the suit, as Judge Hough said, it was admitted. And yet the Navy Department, knowing that, being assured that this man was a vendor of stolen goods, was willing to take.

Mr. HARDY. You say for the purpose of the suit it was admitted; that was in the argument on a demurrer?

Mr. GRIGGS. No; it was not. It was admitted in the suit by the answer of the defendant.

Mr. HARDY. You understand there is a difference between the court stating it was admitted for the purpose of the suit and an admission on the trial?

Mr. GRIGGS. I understand, and I am distinguishing between them. The answer filed by the contractor admitted the validity of the patent.

Mr. HARDY. I am simply repeating your statement, that the court said it was admitted for the purpose of the suit.

Mr. GRIGGS. I should not have said it that way. The Government knew, and I wish you would read the opinion of Judge Hough, as to what he thought of a Government department that would take a position of that kind. But he said he had nothing to do except to enforce the law. Therefore I think I am justified in saying that, generally speaking (and I do not believe a naval officer will contradict me) the Navy Department will take the best they can get, no matter who owns it; they will take it from anybody who can furnish it at the lowest price, and they will leave the patentee to enforce his rights in the Court of Claims, no matter whether his patent is universally conceded to be valid or whether it is contested. In other words, their refusal to pay is not because there is a dispute as to ownership or validity, but because it is not their policy to recog-

nize patents at all. Now you gentlemen ask the Navy Department if I am not right. And if I am not right I will be glad to be corrected.

One other feature. The scientific branches of this will be discussed by others more qualified than I, but there is one feature of this bill with which I must deal, because it is here. And that, it seems to me, is one of the greatest importance and one which should interest every member of the legislative branch of the Government in a most vital manner. I refer to section 14, paragraph a:

"During any war in which the United States shall be a neutral nation."

As I have said, that means at any time.

* * * and in time of threatened or actual war in which the United States may be a party, and in time of public peril or disaster, the President may, by proclamation or Executive order, issue regulations for the conduct and censorship of all radio stations and radio apparatus of every form and nature within the jurisdiction of the United States. Any person who shall knowingly violate or fail to observe any of said regulations shall be punished by a fine not exceeding \$10,000.

Why they did not make it \$27,000,000 while they were at it I do not understand. Now, gentlemen, that confers on the President the power, at almost any time, of making laws against the violation of neutrality. And I want to discuss, for a moment, the law of neutrality. Capt. Bullard, in whose wisdom and knowledge I have a great deal of confidence, and in which I had more before I read what he had said about it, said he was not familiar with any statutory provisions of the United States with reference to neutrality. Well, that is a most astonishing statement for a naval officer to make, particularly a naval officer who has been formulating rules for the preservation of neutrality.

Now, what is neutrality, and who is bound to observe it? Of course the Government is bound to be neutral, but not by statute. You can not pass any law to make the United States Government obey the laws of neutrality which exist as international law. The penalty for their failure to obey the law of neutrality lies in the hands of the nation that has been injured. But when it comes to citizens of a neutral nation the law is entirely different. A citizen may do many things which would be unneutral if done by a government. For instance, a citizen may manufacture and sell munitions to a belligerent. A citizen may loan money to belligerents. A citizen may enlist in a belligerent army and fight for one side or the other. But what a citizen does in violation of neutrality must be in violation of the statutes of the United States. If a foreign government catches him, it deals with him; but the United States can only deal with him where he has violated statute law. And that can only be when he has been indicted, convicted, and sentenced.

The laws of neutrality were framed very early after the formation of our Constitution and they stand on the statute books—against armed expeditions, against fitting out vessels, etc. They have been construed time and time again. When I was attorney general I used to be engaged every week with proceedings against filibustering expeditions, or alleged filibustering expeditions, to Cuba, and we had the remnants of old suits—a captain in Philadelphia, you will recollect, who was convicted after an appeal to the Supreme Court, whose case was affirmed in my day, for fitting out warlike

expeditions in this country. Now, that was unlawful because Congress said it should be. But here is a proposition to put in the hands of the President the power to make neutrality laws. What does the Constitution say?

Congress shall have power to define and punish piracies and felonies committed on the high seas, and offenses against the laws of nations.

Now, I know that in these later times Congress has come pretty close to the line of violation of the rule of delegating legislative powers. It has with reference to the regulation of the railroads—pretty near to it. I would have said, perhaps, that they had overstepped the line. But do you think, gentlemen, that one man—the President—ought to be allowed to exercise this distinct power which is put in Congress to define offenses against the law of nations, which is what the law of neutrality is? Do you think so? I certainly do not. I do not think one man ought to have any right to make laws for the American people—except in time of war—war in which we are a party. Then everybody bows to the supreme necessity. But this gives the President in time of peace—a most serene peace—the power to make laws to be enforced by enormous penalties and by imprisonment. And the kind of laws you would expect to come out of the Navy Department would be those that were colored by the ambition of the Navy Department to control this particular branch of public communication.

This world is not always going to be at war. War is not any longer the daily business of mankind. It is not the thing which our Government was framed to look at as the most immense and important thing to provide for. The arts of peace are those which should be considered, and the military should be subordinate, always subordinate in time of peace, not only to the civil authorities, but to the civil and commercial and business interests of the people.

Mr. GREENE. Amen.

Mr. GRIGGS. You are asked now to make in time of peace the Navy Department superior in this important branch of communication to the civil interests of the country, to the commercial and business interests—to the interests of the 18,000 American stockholders in this company alone. And why should the American Navy, in time of peace, such peace as we enjoyed from 1865 to 1914; because I do not mention the Spanish War, nor the South American war, nor the Balkan wars as affecting us, and yet all of them would have been implied as justifying the President to make laws of censorship in that long period of peace. And what necessity for the American Navy to demand that this great enterprise should be subject to their precedence, nay, to their control? They have obtained precedence under the law of 1912. But in time of peace, when our ships are not manned, when they lie in the docks, when they are under construction, when the fleet is sailing around the world as an exhibit of what we can do in naval architecture and equipment and manning—why should the civil and commercial business of the country be subjected to them? Why, gentlemen, we have known, by our pick-up, when a United States vessel was claiming the right of talking into Newport, because a naval officer wanted to send a message to his girl there. And all the commercial business of the United States must stand aside while that was done by the naval officer. Well, I

do not think it is done any more; I understand it is not. But that illustrates the kind of business that must take precedence over the interests of commerce, over the messages that are wanted to be sent to give the news of the other world. And why, as I say, in time of peace, is it necessary for the Navy to control or dominate this industry? Answer that question, gentlemen of the Navy.

If this is a pacific country, if we are going to have a league to enforce peace or something or other that will prevent war from breaking out, then let us prepare for peace. Let us run the old Government along the old pacific lines and not start a new departure here in which, with no apparent danger in sight, we are causing the loss of millions of dollars to American investors.

There is one other feature. They have a provision in this bill that is so directly aimed at the Marconi company that I must think it was the bull's eye at which they were shooting. They say that no company shall be licensed and, if licensed, it shall lose its license to operate a wireless station, long distance, or any other, if one-third of its stock is owned by aliens, or if any officer of the company is an alien. Will anybody suggest to me, gentlemen, what danger there is to this country because Mr. Marconi is the vice president of the company I represent. Will anybody suggest to me what danger there is to this country because one-third of the stock is owned by aliens, either in Great Britain or Italy? The company is amenable to the laws of the United States. And with what face, now—with what face—can the American Government, through its telegraph companies, go to foreign countries and ask for a concession to land their cables on their shores? The concession for the Western Union cable to Great Britain will expire in two or three years. Suppose the English Government says, when they ask for the renewal of that right, "Gentlemen, you do not allow any American company that has British stockholders to do business with you. You are an American company. We do not see fit to allow you to renew your concession." Is that the kind of a spirit that you want to foster between the nations of the earth? Is that the kind of brotherhood and reciprocity, fair reciprocity, that ought to exist? Why, how can the Government of the United States carry on the wireless business with a foreign country without some arrangement either with a foreign company or foreign Government? And would it not be at all times more dangerous, more likely to violate the laws of nations as to neutrality and get us into trouble, to have the Government conduct the stations than it would be to have a private company do it? You understand that from what I have said.

And how can the United States Navy give the people of this country this great competitive line across the Pacific and Atlantic Oceans unless they have some arrangement either with a foreign company or a foreign government; and how are they to get that if the citizens of that country have been so publicly discriminated against? Why, for Congress to say, as it must be said if they pass this provision in this bill, that Mr. Marconi is not fit to be trusted to hold a position in an American corporation that does a trans-Atlantic business is a most indecent slap in the face. It is what they call shabby treatment of a great man.

Now, gentlemen, I will not take your time any longer. I deeply appreciate the interest and attention you have given me, but I want you to feel that I am sincere in every word that I have said about this. I do not think I have exaggerated a single danger or made a statement with which anyone desiring to do justice and to exercise a wisdom and conserve the rights of the American people in the interests of peace could find any fault.

The CHAIRMAN. General, have you any amendments to suggest to the bill in writing? If so, will you let us have them later?

Mr. GRIGGS. Mr. Chairman, I thank you for that suggestion. I have this to say: We think the law of 1912 affords adequate legislation as administered, and we do not think it ought to be modified or changed except we are willing that Congress should make any provision they think is wise, so that in time of war—meaning war in which we are a party—or great emergency or tumult, the stations of a wireless company may be taken over by the Government and all the employees sworn into the service of the Government. Or, we will go further, if it can be worked out. We will agree that every operator in a station on American soil shall be sworn into the reserve service of the United States, so that he is bound to respond to any military law when the exigency arises. That is what we are willing to do, and that, I think, would be a wise provision. It would answer all this charge against aliens, and everything of that kind, and it would give the Government a right to control the stations. And we won't ask for payment in advance, because there is a war at the time. We will take it when we can get it, because we assume if the Government does that they will deal justly with us, and Congress will do it and not the Court of Claims.

That is the only suggestion we can make, because all of these objections are so mixed up with the whole texture of the bill that they can not be separated. Does that answer you, Mr. Chairman?

The CHAIRMAN. Yes. I am obliged to you for the suggestion.

(The committee thereupon took a recess until 2 o'clock p. m.)

AFTER RECESS.

The committee reconvened pursuant to the taking of the recess.

The CHAIRMAN. We will proceed with the hearing, gentlemen, whenever you are ready.

Mr. GRIGGS. Mr. Chairman, I will file with the committee, for reference, the transcript of the record in the case of the Marconi Wireless Telegraph Co. of America *v.* Simons, now pending in the United States Supreme Court on writ of certiorari, which is the case I referred to this morning as being a case where the defendants admitted all the statements contained in the plaintiff's moving papers relating to the patent, its construction, and manufacture. And I think it would be useful for the committee to see what the law is in reference to this matter of infringement by contractors with the Government, so far as it has gone. The Supreme Court has the final word to say about it, of course.

Mr. HADLEY. Has the case been submitted in the Supreme Court?

Mr. GRIGGS. No; it is on the list now.

Now, Mr. Chairman, Mr. Bernard, a gentleman here representing the steam engineers, has just one suggestion to make to the committee, and, after he is through, I would like the committee to hear Mr. Nally, vice president and general manager of the Marconi Co.

STATEMENT OF MR. WILLIAM E. BERNARD, NEW YORK, REPRESENTING THE NATIONAL BOARD OF STEAM ENGINEERS.

Mr. BERNARD. We come here in a sense in opposition to the bill, saying that under present circumstances the system with which we have our ships equipped has been especially satisfactory to our members. We have had no complaints come to us from the various lines which our body represents, no objection to the present system, and, in one sense, are opponents to that extent.

They have suggested an amendment to the bill on page 14, section 12, in the twelfth line (beginning, of course, in the eleventh), the words—

An operator's license shall be issued only to a person who, in the judgment of the Secretary of Commerce, is shown to be proficient in the use and operation of radio apparatus.

We would like to have, in line 12, the word "only" obliterated, and between the words "issued" and "to a person" to insert "19 years of age or over," having the sentence read—

An operator's license shall be issued to a person 19 years of age or over, who, in the judgment of the Secretary of Commerce—

and so on.

We suggest no further changes. We will send the amendment to you in writing at the request of our board. Our reasons for so doing are these: At the present time there is a ruling of the Department of Commerce that the Steamboat-Inspection Service, which holds the hearings, shall grant a license to applicants for deck officers as well as engine officers at the age of 19 years. We have found in the recent years, owing to an increased trade, a demand for officers in our vessels; and so we have found a demand for operators. There have been times when we have not been able to get them. As you know, the law requires one, two, and three operators on duty on the passenger ships, and especially radio operators, and the supply is becoming quite diminished. And we feel as the high schools in all cities to-day are educating the young men in wireless telegraphy, as you will know from the records from these departments, that the young man at the age of 19 years has become quite proficient as an operator of a wireless system. And in some instances they have, in the training schools, prepared their instruments and installed them. And we think it is in justice to the American boy to-day that he be recognized and that at the age of 19 years he be granted a license as an operator for wireless or radio systems. And we feel this will be in accordance with the ruling that has been made by the Department of Commerce, and we really feel that it is necessary and due to the American boy.

And in defense of this, I wish to mention that there is a bill already in the hands of this committee which compels the employment of a man as a radio or telegraph operator on board of a ship to be 21 years of age. That bill, of course, has not been passed out of the hands of the committee, but we feel that the committee should consider the amendment as we have mentioned here—at the age of 19 years.

I thank you for the interruption and trust the committee will give the amendment due consideration.

Mr. HARDY. You have no objection to that feature of the bill requiring licenses not to be issued to any alien?

Mr. BERNARD. No, sir.

Mr. GRIGGS. I will now introduce Mr. Nally.

**STATEMENT OF MR. E. J. NALLY, NEW YORK, VICE PRESIDENT
OF THE MARCONI WIRELESS TELEGRAPH CO. OF AMERICA.**

Mr. GRIGGS. Mr. Nally, you reside in New York City?

Mr. NALLY. Yes, sir.

Mr. GRIGGS. You are vice president and general manager of the Marconi Co.?

Mr. NALLY. Yes, sir.

Mr. GRIGGS. Before that you were connected with a telegraph company?

Mr. NALLY. With the Western Union and Postal Telegraph.

Mr. GRIGGS. How long were you so connected?

Mr. NALLY. For 38 years.

Mr. GRIGGS. Do you understand the art of telegraphy?

Mr. NALLY. Yes, sir.

Mr. GRIGGS. The metallic circuit and wireless circuit?

Mr. NALLY. Yes, sir.

Mr. GRIGGS. Now, you may make your statement to the committee.

Mr. NALLY. It is recommended in this bill that the Government be permitted to acquire and operate all commercial coast wireless stations; that the Government, through the Navy Department, assume a monopoly of the commercial radio business of the coasts of the country, which means as well all ship-to-shore communication.

It is conceded in the recommendation that the Government now owns and operates sufficient radio stations and has ample congressional authority for the construction of others for its entire needs. Congress has also permitted certain of the naval radio stations to do a commercial business. This commercial-service feature was adopted to meet commercial needs, particularly in Alaska, and at some other points where no commercial stations had then been established.

The Radio Bureau of the Navy reports that it has handled this commercial service entirely to its credit and benefit. In recommending the extinction of commercial competition, complaint is made that the operation of the commercial companies prevents the naval operators from obtaining the requisite amount of telegraphic practice.

Section 5 of the bill provides for the opening by the Government of its radio stations to general public business, and if this provision is enacted into law it will create a condition of competition between Government and private interests, resulting in a heavy financial loss to commercial companies, which have spent considerable sums of money and years of labor in the development of efficient radio stations, so as to provide a satisfactory commercial wireless-telegraph service to the public.

Section 6 seems to anticipate the condition referred to in the preceding paragraph, in that it provides that—

The Government, through the Navy Department, shall have authority to acquire, by purchase at a reasonable valuation, any coastal radio station now in operation in the United States which the owner may desire to sell.

Much has been said during the hearing given by this committee to the proponents of this bill about the willingness, even the anxiety, of the commercial companies to dispose of their coastal stations to the Government.

So far as the Marconi Co. is concerned, no one has been authorized to make any such statement, and I can only think that with the Navy Department the wish is father to the thought.

It is not stated who shall determine on the reasonableness of the valuation which the Navy Department may wish to place on property belonging to commercial interests.

The values which have already been stated by the spokesmen for the Navy before this committee are perfectly ridiculous in the light of the Marconi Co.'s investment, and the figures which they mention as being adequate for the purchase of the coastal stations and the high-power stations of the entire country represent far less than the investment of the Marconi Co. alone.

The Marconi Co.'s principal business is that of selling service. While it does manufacture some apparatus for sale, yet this branch of its business is merely collateral and is not its principal object, which, I repeat, is to sell service.

For this reason it does not sell apparatus to ships, but it sells ships certain service for a certain sum per month, just as the telephone company or electric-light company sells its service to a customer.

In order to give perfect service and to make the apparatus which it installs on ships serviceable in the greatest degree, it has erected and maintains land, or coastal, stations from the most northerly point on the Atlantic coast to the most southerly point; on the Gulf, on the Great Lakes, and on the Pacific coast to northerly Alaska.

These stations were erected and are maintained as the essential, indeed vital, link in ship and shore service, and the long list of rescues at sea and of lives and property saved because of the ready response which ships in distress at sea have been able to obtain by reason of these coastal stations, cooperating with other ships at sea, makes a long and honorable record of which any company may well be proud. And this tremendous service in the salvation of life and property already rendered by wireless has earned for it at least the right to be developed and made useful and available to the fullest possible extent.

Such development can only come through private enterprises. It is impossible to formulate legislation which will foresee and provide for the future usefulness of radio communication. It is just as impossible to formulate legislation which will place on the Navy Department or any other Government organization the responsibility for increasing the commercial use of radio communication in its present state of availability. If the Navy Department had been given a monopoly of the telephone when that means of communication was first developed, would the United States to-day have, as it has, the greatest telephonic development of any country? And yet the telephone has not supplanted the telegraph. It occupies an entirely new field created for it by the persistence of private enterprise.

It is true, as the proponents of the bill have stated, although they lay entirely too much stress and make too much of the fact, that these coastal stations per se are not money makers for the company, but

as part of the complete service they are essential, and what they contribute to the service is vital.

Are not telephone exchanges vital to the telephone service? Do telephone exchanges per se or the great main operating rooms of the different telegraph companies per se earn money for the telephone and the telegraph companies? They contribute the vital and necessary service to make the whole service complete. Who would think of separating the central exchange from the work that it performs for the subscriber or the main operating room of the telegraph company from the customer or the branch office through which the customer deals? No one save the Government.

The Government could do such an unbusinesslike thing, because the Government is not in business. The Government has not the experience to be gained only in business getting. The Government's sole function is to spend; it does not have to earn money before it can spend it. Its method is a complete reversal of business methods. It can spend money that it does not earn. Commercial companies must earn so that they can spend.

In 1912, when the plans of development of wireless telegraphy in contemplation by the Marconi Wireless Telegraph Co. of America were being discussed, President Taft accorded the Hon. John W. Griggs, president of the company, an interview, at which he explained the company's plans to the President and representatives of all the Government departments, as well as the military.

At this interview he made the Government the following proposition:

That in connection with its scheme of transoceanic wireless commercial service the Marconi Wireless Telegraph Co. of America would enter into a contract with the Government to build, in the Canal Zone and in the Philippine Islands, at its own expense, under the direct supervision of Mr. Marconi, and to be equipped with the most approved apparatus known to the art, high-power wireless stations, capable of communicating 3,000 miles, and the Marconi company would agree to operate same, under an arrangement with the Government as to rates and service that would be just and fair, giving preference at all times to Government messages; agreeing that the employees and operators connected with the stations should be so attached to the Government service as to be subject to impressment at any time the Government might take over the operation and control of the station; and also agreeing that at any time, on notice by order of the President of the United States, the Government, in case of riot, tumult, disorder, war, accidental catastrophe, or other emergency, might take over the control and operation of the stations for such time as, in the judgment of the President, the public interest might require.

It also agreed to erect these stations within such a reasonable time as the judgment of the Government might require, and generally agreed to such terms and conditions in the carrying on of commercial business by arrangement with the Government as might be found reasonable and just.

At this same meeting it was explained to President Taft that the Government of Great Britain had entered into a contract with the British Marconi Co. whereby that company assigned to the British

Government the right to use the patents and inventions of Mr. Marconi, and agreed to build a chain of high-power stations between Great Britain and her various dependencies in Europe, Asia, Africa, and Australia. A system of high-power long-distance stations thus constructed would insure the benefit of direct and friendly communication with stations to be erected for the British Government.

Our proposition in connection with the Canal Zone and the Philippine Islands was not given consideration. The Government has since gone about this work independently and at great expenditure of public money.

Since 1912 the Marconi Wireless Telegraph Co. of America has completed great stations on the Pacific coast and in Hawaii for service between this country and the Hawaiian Islands and Japan. The service with Hawaii was opened up on September 24, 1914, and with Japan on November 15, 1914. The delay to the latter service was owing to the delay in completion by the Imperial Japanese Government of its high-power stations near Tokyo.

The American Marconi Co. also completed high-power stations of the same type as those constructed on the Pacific coast in New Jersey—the transmitting station at New Brunswick and the receiving station at Belmar—for service with Great Britain. But before these stations could be operated for commercial service, indeed, while they were being tested out, the great European war broke out and England took over the stations in Wales which were to work with the New Jersey stations.

The Marconi Co. has about completed similar stations, of great power, in Massachusetts, the transmitting station at Marion and the receiving station near Chatham, Cape Cod, for trans-Atlantic service with Norway and Northern Europe. The war has also interfered with this service; Norway was unable to complete its station, and England would not permit the shipment out of the United Kingdom of the high power apparatus which was being manufactured abroad, under Mr. Marconi's personal eye, for the Marion, Mass., station.

The Marconi Co. insists upon its ability to handle long distance business for the Government, and for the public, cheaper and better than the Government can do it.

It repeats its offer to constitute its staff, its equipment, and its general organization, as an arm of the Government in times of war, or stress, or peril.

It asks, in the meantime, that is, in time of peace, to be permitted to conduct its commercial service and to continue its development and extension of the art.

It recognizes that in the radio service there exists a potent power for defense in time of war, and in preparation for war.

On this point it is acknowledged that in time of war, military necessity should not be under the slightest obligation to take into account the industrial or commercial welfare of the nation; but serious consideration is asked when it is proposed, on the ground of military necessity to legislate the government into the permanent monopolization of an industry.

Particularly weak must be the claim of military necessity to monopolize the commercial wireless business, inasmuch as Congress has but recently provided for more complete Federal control over

radio communication than has been taken over any other industry. This control goes to the extent of providing that no radio station may be erected without a Federal license; the operation of any station may be suspended under Federal authority, and any and all stations may, by order of the Executive, be placed completely under the control and operation of Federal employees.

It is a fair statement then, that the present request to have the Government take a monopoly of the commercial coast wireless business is not justified on any ground of military necessity.

Other great nations recognize that commercial companies have contributed to the value of the art, and while England, and Germany, and France, and Italy, and Canada, and other countries have, and are making the most of radio possibilities, still they have left the development of the art to commercial companies, even assisting them by subsidy, and financial allowance.

England, for example, encouraged private companies to the extent that the Marconi Co., for instance, was able to build up an immense works at Chelmsford, employing thousands of men, which was immediately taken over by the Government for military purposes, and there practically all of the wireless apparatus needed for the war has been constructed.

England also took over a large part of the Marconi staff, having held them in reserve for this purpose.

Germany has done precisely as England did. Germany has encouraged the private companies, leaving the development and manufacture of apparatus to such great concerns as the Siemens & Halske A. G., the Siemens Schuckertwerke G. m. b. H., and the Allgemeine Electricitats Gesellschaft, utilizing their skill and product for its military purposes.

Canada not only leaves the operation of the coast stations to the Canadian Marconi Co., which practically has a monopoly of the business in the dominion, but has assisted the company by generous subsidy and allowance.

The Marconi Co. of America has never asked for subsidy, or assistance of any kind, except the right to carry on business and develop the art, just as other telegraph and telephone and other public utilities are doing.

Radiocommunication is in the very infancy of its possibilities, yet there is already an investment of \$40,000,000 in its commercial development in the United States.

Rightly considered, all of this investment, representing the latest and most powerful stations and trained organizations, is an adjunct to the Government in times of military necessity. If opportunity for development is left open this investment—this equipment and the personnel—will increase, and all are completely at the disposal of the Government in times of need.

In view of these considerations it would seem that where the development of an industry which lends itself naturally and completely to the possible military necessities of the country, and over which the Government is exercising complete control, there exists not a single valid reason for making such an industry a Government monopoly.

There is also an important international phase of the radio problem, the solving of which requires the development of extended

control of equipment standards, operating practice and language qualifications. If the ships of the sea are to develop among themselves and to the short, universal intelligible communication, which is undoubtedly within the possibilities of radio development, a Government department, it will be admitted, can hardly be qualified to insist on the disciplining of an operator on a foreign ship who may be lax in duty or deficient in qualifications. There are daily possibilities here for the development of unpleasant and embarrassing international complications.

Private enterprise is already working out this problem through the means of equipment contracts, binding ships to employ only operators possessing standardized qualifications as to language, etc., and amenable to a central discipline as to the observance of certain mechanical and operating regulations.

The abandonment of the ideal of the universal intelligibility of wireless is to abandon its future development; but such abandonment is inherent in a government monopoly of the art, as can readily be seen from the limitations of the jurisdiction of a government, and the cumbersomeness of its international representation.

A good deal has been said at the hearing by the proponents of the bill as to the need for taking over existing high-power stations.

It is not clear whether they wish them solely for Government work or to do a commercial business in competition with the cables.

If, for example, this Government were to take over our New Jersey stations, how could it operate them for commercial service with Great Britain, except through a connection with the Marconi Co. of England, which owns the corresponding stations in Carnarvon and Towyn?

If it takes over the Sayville and Tuckerton stations, now the property of private companies in America, would they continue to work with the privately owned stations in Germany? And in what way would the Navy, or the Government, benefit by such an arrangement?

From every possible point of view there is not a sound reason for placing the Government in the commercial radio business. There are controlling reasons of every character why this should not be done.

In closing, I wish to say that it is a matter of record that the Marconi Co. has repeatedly offered to place at the disposal of the Nation its stations and its operators, even going so far as to secure from its operating personnel individually signed expressions of readiness to enter Government service in event of war, which records were all turned over to the Navy.

The Vera Cruz incident also brought forth a voluntary offer for the free use of Marconi stations for the battleship fleet, tendered to the Secretary of the Navy, and accepted.

Before leaving New York I arranged, at the request of Rear Admiral Worthington, to furnish him with a list of all employees engaged in our Aleene works, with the idea of constituting the entire force, including the official staff, a naval reserve, to be called upon by the Navy in time of emergency.

Mr. HARDY. Something was said in some part of the hearing about the development of a private monopoly. Has there been any ten-

dency for a big company to buy up the little ones in the wireless field?

Mr. NALLY. I know of no monopoly, except the monopoly of patents.

Mr. HARDY. There has been no effort to buy out and combine all the private companies?

Mr. NALLY. No; absolutely none.

Mr. HARDY. How many different companies are there?

Mr. NALLY. There is only one large operating company, and that is the Marconi Co. I think we operate perhaps 98 per cent of all the ships.

Mr. HARDY. That is, all the ship-to-shore service?

Mr. NALLY. Yes, sir.

The CHAIRMAN. How many high-power stations are there?

Mr. NALLY. Outside of the Marconi Co.?

The CHAIRMAN. Outside of the ship-to-shore business?

Mr. NALLY. There is the high-power station of the Marconi Co. in California, and also one in Hawaii, to operate with Japan. There is also a high-power station at New Brunswick, which is a transmitting company.

Mr. GRIGGS. He wants to know outside of the Marconi Co.

The CHAIRMAN. Yes; outside of the stations of the Marconi Co.

Mr. NALLY. I only know of two—Sayville and Tuckerton.

Mr. GRIGGS. And the Poulsen has one?

Mr. NALLY. Yes; and the Poulsen Co., in California.

Mr. GRIGGS. And Arlington, of course.

The CHAIRMAN. That is not a commercial station, is it? Is that a commercial station at Arlington?

Mr. GRIGGS. Yes; they can do a commercial business, can't they?

The CHAIRMAN. But that is a naval station. I am speaking of the stations outside of naval stations.

Mr. NALLY. Those are the only ones.

Mr. GRIGGS. That is a naval station at Arlington?

The CHAIRMAN. Yes.

Mr. GRIGGS. Let us make it clear. There is direct competition between the Sandwich Islands and San Francisco, between the Marconi Co. and the Poulsen Co., or the Federal Co.

The CHAIRMAN. That is what I had in mind.

Mr. GRIGGS. Yes. There is no competition between Germany and the United States, except such as may exist between the Tuckerton and Sayville stations, both of which are now being operated for the owners, without license, by the Government. But there has been no consolidation of owners. There have been arrangements whereby some companies owning a patent for one thing have given the right to the Marconi Co. to use their patent on payment of a royalty, and the other companies have agreed to pay the Marconi Co. a royalty for the use of their patents; but nothing in the shape of consolidation or anything that was not strictly paying for what they had a right to sell.

Mr. HARDY. I understood Mr. Nally to say the Marconi Co. did about 98 per cent of the commercial business now.

Mr. GRIGGS. Ship business. They are equipping and licensing ships with apparatus.

Mr. HARDY. Do they not also transact commercial business which is not ship-to-shore messages?

Mr. NALLY. Yes, sir.

Mr. GRIGGS. Except what the Navy does. I do not know what they do.

Mr. HARDY. I am leaving it out; I do not call that commercial, whether it is or not. I mean privately owned companies.

Mr. GRIGGS. Yes.

Mr. HARDY. Is it not a fact that naturally one big company will tend to occupy the whole wireless field in the end, and that not very far away?

Mr. NALLY. Well, I think it would be a good thing if that were true, just as it would be a good thing for telephony.

Mr. HARDY. That is possibly true. And I say the tendency is in that direction?

Mr. GRIGGS. I think there is a modification to that, Judge. I do not think the Marconi Co. will ever control any line to Germany; I do not think they will ever control any line to France. Nor do I think any line will probably compete with them to Great Britain for this reason, that they can not make any arrangements in Great Britain for the privilege to do so, because it is not necessary. It is a sort of monopoly that seems to be natural as confined to particular countries. Do you get the point?

Mr. HARDY. I do not mind saying to you, General, just what was in my mind.

Mr. GRIGGS. Yes.

Mr. HARDY. I know the telephone system in towns, large or small, naturally serves the people much better if all the systems in a community are under one control.

Mr. GRIGGS. Yes.

Mr. HARDY. Possibly the telephone system of the whole country ought to be under one control. But the question with me is where a business is practically and naturally a monopoly should it be owned by private individuals?

Mr. GRIGGS. I do not think this is a natural monopoly when you consider the great profit-making part of it, its competition with the cables, or those trans-Atlantic companies. That is the great profit-making part of it. And competition for that might be confined to one company with one country and with another company for another country. I do not say it would be necessarily confined to one company, but it would probably be. But I doubt very much whether Germany would ever permit the Marconi Co. to have a station in Germany, and I doubt very much whether England would ever permit a German company to have a station in England; that is all. That is not a monopoly. That is not like a telephone company controlling all lines between the Atlantic and Pacific; it is quite different.

The CHAIRMAN. But when competition between the cables and wireless becomes serious the probabilities are that one or the other will absorb all the wireless and the cable.

Mr. GRIGGS. I do not think so, sir. I do not think you would let them; I do not think Congress would permit it.

Mr. NALLY. That is not true. I can state one instance right in connection with competition. Before the wireless was in use between

California and Hawaii the total cable traffic between the Hawaiian Islands and this country did not exceed 30 or 35 messages each way per day. Since the wireless competition the traffic there has increased to hundreds of messages a day, all under the spur of lower rates, which creates an entirely new form of traffic.

Mr. HARDY. You mean by that that the cable rates have been lowered and the messages have increased over the cable?

Mr. NALLY. Yes.

Mr. HARDY. Since the wireless came into effect?

Mr. NALLY. Yes; by reason of reduced rates and by reason of innovations which the wireless companies made in connection with week-end and night-letters service.

Mr. HARDY. Isn't it a fact that all this service increases in volume as it lowers in price—the telegraph, telephone, and everything else?

Mr. NALLY. Not always. My experience in land-line telegraphy, where I have been with competing companies and where we have invaded entirely new fields, is that we had to fight for messages. We were not able to increase traffic of that field. We divided it, but we did not increase it, and we had to struggle along there for years. I started in with Mr. Mackay, in the early days, and I know for many, many years we had to struggle for business.

Mr. HARDY. I just know from what arises here—whenever they cheapen the service they have more.

Mr. NALLY. I think that is true. That is our object. There will be enough business for the cables and plenty of business for the wireless companies to enable them to reduce rates.

The CHAIRMAN. Who is your next witness?

Mr. GRIGGS. Mr. Kintner is here representing the National Electric Signaling Co., which is a competing company, although it is not in the trans-Atlantic business at the present time.

**STATEMENT OF MR. S. M. KINTNER, REPRESENTING THE
NATIONAL ELECTRIC SIGNALING CO., OF PITTSBURGH, PA.**

Mr. KINTNER. With reference to Gov. Griggs' last statement, that the National Electric Signaling Co. has no trans-Atlantic system, I wish to modify that to this extent, that the National Electric Signaling Co. owned the first trans-Atlantic stations that ever successfully transmitted and exchanged messages between Europe and America. Those two stations were located at Brant Rock, Mass., and Machrihanisch, Scotland. I see Mr. Pannill here, who is now connected with the naval service, who was the operator at Markinch during part of that transmission. He is present to-day.

Our company was organized some 14 years ago for the purpose of developing a wireless system which was the invention of one of the original incorporators of the company. This company has not sold a dollar's worth of stock, but, on the other hand, all of the money that has been spent has been supplied by the four original stockholders. These gentlemen have always had the greatest of faith in the future of wireless telegraphy and were willing to risk their own money in perfecting a system to bring about its successful operation. They believe that the time has arrived when they should be allowed the opportunity to reap the benefits of their struggles of 14 years. The National Electric Signaling Co. are the owners of over a hun-

dred United States patents and several hundred foreign, all relating to wireless telegraphy and telephony. These patents are broad fundamental patents, covering important features of the art as it is practiced to-day. This company has supplied the Navy with a large quantity of apparatus, both for ship stations and for land, the Arlington station equipment having been furnished by this company.

I have been interested in wireless since its beginning, and have been directly connected with the National Electric Signaling Co. for the past six years, acting during all of this time in the capacity of general manager.

In what I am about to say in discussing this bill, I wish it to be understood that our company and its men yield to no one in their patriotism or loyalty to their country, and what is said in the following is urged strictly from the standpoint of right and is not set forth from any narrow selfish point of view.

As I understand the arguments presented by the proponents of the bill, in urging its approval by this committee, there are three principal points upon which they rely. These are in the order of their importance as stated by the proponents: first, military necessity and national defense; second, the elimination of interference between stations; third, improved facilities for practice by the Navy operators.

These several points will be discussed in their order and following that, such other questions as have been raised, but which do not properly belong to anyone of the three classes, will be taken up.

National defense. The statement has been made that Government ownership of wireless is essential for national defense but we have not been shown in what way it is necessary. The Army and Navy Departments have made this claim and the burden of proof is upon them.

They say it is necessary and I say it is not and will give reasons which will prove our side of the contention.

The principal point urged by Commander Todd as showing the need of Government ownership was the difficulty of maintaining neutrality during times of war.

Why is it unneutral to send by radio, let us assume, a coded message to Germany that gives her some information re. English or French shipping and perfectly neutral to send the same kind of message to England by cable that gives her information re. German submarines, commercial or war?

The Navy undertakes to answer that by saying that the wireless message can be intercepted and understood by those for whom it is not intended. Well what of it? If it is an unneutral message such interception by the injured party would tend to minimize the effectiveness of the information and thus lessen the offense. This claim of the Navy, that the cable does not need a censor and the admission thereby, that it is all right for England to get any information about Germany, so long as Germany does not find it out, is certainly a preposterous one.

For a homely illustration let us assume two men are engaged in a fist fight and a bystander, presumably neutral, whispers in the ear of one of the men that the other one is about to trip over a stone.

Would you consider that a more neutral act than if a bystander called out the same information so that both could hear?

The Navy point to the fact that information sent out by wireless can be picked up by German raiders and thus an unneutral act result to England and her allies. They don't tell you, however, that England has wireless stations in Canada, Jamaica, and Bermuda connected to this country by either telegraph or cable lines over which any information can go uncensored and then spread broadcast, in coded messages, by the above-mentioned wireless stations to the English ships all over this side of the Atlantic.

It is a well-recognized principle of law that what can not be done legally directly can not be done legally indirectly. It appears to me that this principle must certainly apply in this case. Therefore, if the neutrality of this country can be preserved, as claimed by the Navy Department, only by the Government owning the radiotelegraph systems, it must also own the cables as well. There is no difference between the two systems, if one needs a censor then the other does too.

That this equivalent is a well-recognized principle of international law and that this whole Navy idea of censorship is wrong is shown by those chapters of the second peace conference at The Hague (as reported in 2 American Journal of International Law, p. 118), relating to the duties and rights of neutral powers in their use of wireless and cables during the time of war:

Article 3.—Belligerents are likewise forbidden: (a) To establish on the territory of a neutral power a wireless telegraph station or any device intended for use as a means of communication with the belligerent forces on land or sea; (b) To utilize any station or apparatus of this kind established by them previous to the war on the territory of the neutral power for an *exclusive* military purpose and which has not been open to the use of the public for correspondence.

Article 8.—A neutral power is not required to forbid or restrict the use, in behalf of belligerents, of telegraph or telephone cables or wireless telegraph apparatus belonging to it or to companies or private individuals.

These two articles certainly show what is required of a neutral country in order to preserve its neutrality in the use of its systems of communication. It shows that they are not to be restricted in their use of them. Any of them—there is no distinction made there between wireless and cables or wire lines.

This whole matter of censorship of radio, I have always believed, was part of a systematic scheme upon the part of the Navy Department to incite public opinion so as to influence Congress in passing a law to give them complete control and ownership of radio.

This question was asked by one member of this committee of Commander Todd: "Whether there would not be an increased risk of breach of neutrality if the Government was operating the wireless stations in times of war with the United States over what would exist with commercial companies operating them?" Commander Todd thought not, and in this opinion he is in direct conflict with the authorities, for instance, Woolsey on International Law, page 27, says:

International law does not require of the neutral sovereign that he should keep the citizen or subject within the same strict lines of neutrality which he is bound to draw for himself.

It must be clear from this that there is greater danger of breach of neutrality with the Government owning and operating the stations than with the wireless companies in control.

This whole matter seems to me so clearly one of just common sense, that I am surprised that anyone can have any other view. There is nothing more mysterious about wireless than there is about the cable, and I have not a doubt, that if wireless had been discovered and put to use prior to the cable, and we were all familiar with it by long use, that we would now be questioning the effect of our neutrality of permitting the use of the cable. It is generally admitted to be bad manners for two people to whisper in the presence of others, then, Why isn't it bad manners for England to whisper to the United States by cable "Please send me some more shells?"

Another reason urged as showing the necessity of Government ownership is the need of a radio organization which can be at once utilized as part of an already existing system, in the event of war. This is a strange argument when we think of the arguments for building up our merchant marine which occupied so much of your attention during the last session of Congress in debates on the so-called "shipping bill." There it was urged that the Government should buy ships and lease them to private operators. It was pointed out that then they would be most quickly and effectively available to assist our Navy in time of war. Why has the Navy Department so completely shifted its ground? It is simply an auxiliary service in both instances, and certainly there should be no difference in the manner of perfecting the operating organizations.

Let the commercial companies alone and they will, without expense to the Government, erect, man, and maintain all of the radio stations that can be used economically. There is no danger of over-production. When stations become too numerous, some will fail and go out of business. The ones that survive will survive because of their fitness and then if we become involved in war our coasts will have an ample number of stations to effectively do all of the radio work required of them.

Commander Todd's great excitement over the existence of three high-powered stations on one of the Hawaiian Islands is amusing. Capt. Bullard did not see any great danger in this condition. He in fact did not propose to buy the high-powered stations at all. The two commercial stations in Hawaii are not complaining of each other or the Navy; why should the Navy complain of them? If there is enough business to make three stations necessary, then why shouldn't they exist? They can all be seized and closed or operated by the Government in time of war as they may see fit. If it is not economical to have three there and the lack of economy so offends the Navy, why did the Navy Department build there; theirs was the last of the three stations erected? They could have saved this country the expense of this station and relied upon the other two.

Anyone familiar with the workings of commercial radio stations knows that they are more skillfully handled and secure better results than corresponding stations of the Navy. This always has been and will continue to be so long as the two exist. This is due largely to the reasons given by Commissioner of Patents Ewing—i. e., that the commercial companies' men devote their lives to this specialty and are not, as is the case in the Navy, putting in the time of an

assignment to that particular duty. Therefore, if effective organization is required, don't count upon Government ownership and Navy control as the way to get it.

A serious question for some of the best, most experienced, and hence most trustworthy radio operators of the commercial companies would at once present itself if all of the coastal and high-powered stations were owned and operated by the Navy Department. All Navy operators must be enlisted men, and hence must pass certain physical examinations, and also the age of enlistment is limited to not over 30 years. What then would these men do? Many of the best operators could not pass the physical examination. They would be compelled to give up that as a means of livelihood or seek service at a much lower rate aboard commercial ships. Many of these men have families and would give up radio if compelled to be away from home; thus the art would lose at once a number of the most expert operators and the law authorizing the Government ownership would be directly responsible for the men losing their means of support.

Second, interference. The second principal reason assigned by the proponents of the bill for the need of complete Government control is to prevent interference between stations.

The principal cause of interference is the result of a law passed by Congress four years ago at the very earnest solicitation of the very same people that are now urging the bill under consideration.

The Government-ownership advocates have tried to convince you that dreadful interference exists which brings about a chaotic condition. Secretary of War Baker, with his admittedly incomplete technical information on the subject, compared it to two or more systems of railways operating over the same track. His comparison in some respects is more exact than the Government-ownership advocates would have you believe.

Now, let me explain briefly—as Commander Todd promised our side would—just what we mean by interference, how it is caused, and how it can be avoided. This explanation is given not to befog, as Commander Todd stated would result, but to make clear to you our reasons for opposing this proposed legislation and not have to ask you to accept only our opinions on these matters.

Wireless messages are sent out by electromagnetic waves, just like water waves that result from dropping a pebble in still water. They pass out in all horizontal directions in concentric circles, with the transmitting station as the center. These waves have, among other characteristics, that of length and frequency. The length of a wave is the distance in meters from its crest to that of the next preceding or succeeding wave. The wave frequency is the number of waves produced while one of them is traveling outward the distance it can go in one second of time. Thus wave frequency can be determined readily when we know the wave length of a wireless wave, as we know that the velocity of the wave away from its source is the same as that of light, i. e., 186,000 miles per second or 300,000,000 meters per second. A wave of 600 meters is then found to have a frequency of 500,000 by dividing the 300,000,000 by 600.

Now, the wave length does not have anything to do directly with the distance of sending, and so distance of signaling and wave length should not be thus confused.

Electrical circuits have, under proper arrangements, the same characteristics as the string of a musical instrument, such as a piano or violin; that is to say, when they are disturbed, they vibrate at a certain rate of vibration. Now, you are doubtless all familiar with the fact that when a certain musical tone is sounded in the presence of several such musical strings, that string which, if disturbed by picking or bowing, gives out that same musical tone is the only one that will respond.

This property of selection is made use of in the electrical circuits to enable a receiving station to select a particular sending station and exclude another sending station sending on a different wave length. The wave lengths of the electrical wireless waves are analogous to the pitch of tones of musical instruments. The bass tones have the long wave lengths and the higher-pitched tones the shorter wave lengths.

The wave lengths in wireless perform the same function, then, in the practical operation of that system as the different wires do in the ordinary telephone system. They each give an independent highway over which a particular transmission can be effected without interfering with a neighboring one.

Four years ago a bill was passed by Congress compelling all stations open to general public business to use a wave length of 600 meters. In other words, Congress, at the request and after the most energetic efforts of the Navy and other Government departments, compelled all stations to get on the same "highway," and as a result there has naturally been some interference. That there has not been more is a glowing tribute to the effectiveness of the organization and the operation of the commercial companies.

You can now see the application of Secretary Baker's two or more railroad trains on the same track, and can also understand who is responsible for putting them there.

Would you expect good, prompt, and satisfactory telephone service if all your phones in this building were on one wire? That is the condition that the existing radio law imposes on the commercial wireless companies.

On the other hand, the Navy is free to use any wave length and is not in any way amenable to the wave-length restrictions. If, then, the Navy has suffered from interference, it shows how unskillful their men have been.

Our company operates some 14 or 15 stations on steamers on Long Island Sound and has 3 shore stations in the same service. We have but little trouble from interference, and would have practically none if we could use different wave lengths. We are operating around New York, where interference is the worst owing to the large number of ships and other stations. I have talked to the other commercial companies and find that their experience is the same as ours, and I am sure they will so advise you.

It has been stated by the proponents of the present bill that the high-powered stations, of course, caused interference to near-by ones owing to the enormous power radiated. We are operating very near to Sayville and are not interfered with in the least, even though they are sending out signals of strength sufficient to reach Germany, 4,000 miles away.

We recently made a sending test of eight hours a day for a period of one month between New York and Boston and never received a single complaint from anyone of our interfering, though our sending was all done in daylight. We are now preparing to install a station at Boston to begin a regular service between these two cities.

Regarding the statement of the representative of the Coast Guard Service, Lieut. Waesche, that great difficulty is experienced by the coast guards in effecting rescues where distress calls are sent out, due, as he says, to the large number of stations answering the call and the confusion that results from so many answers, will say it is true that many answers are received to all distress calls sent out, but I have yet to learn of a single instance where this great number of answers has resulted in serious delay which caused loss of life. The fact that many answers are received is evidence of the alertness of the operators and must certainly give those on board a ship an added feeling of security.

If you were on a vessel calling for help would you care who it was that answered your call? You would want help from the one who could reach you first, and you wouldn't care whether it was a Government ship or a merchantman. It is the ship stations anyway that in most cases do most of the answering of distress calls and this bill is not intended to have any effect on them.

There is just one other thing that needs to be said in this connection as an answer to the complaint made by the Coast Guard Service against the great number of replies to distress signals and that is this. All stations hearing a distress call are compelled by existing international laws to answer that call.

See Article XXI of the regulations affixed to the International Radio Telegraph Convention, London, 1912. The last paragraph reads:

In case the call letters of a particular station are added at the end of the series of calls for assistance, the answer to the call shall be incumbent upon that station alone unless such station fails to reply. If the call for assistance does not specify any particular station, every station hearing such call shall be bound to answer it.

The present radio law should be amended so that the commercial companies are allowed freedom in the selection of wave lengths and the Navy and Army, in times of peace, restricted. At present the Navy can use any wave length and they do. The radio law does not compel a purity of radiation from them, as it does from the commercial companies and consequently the Navy operators are careless in their adjustments.

We advocate now, as we did in 1912, when the present law was enacted, the division of wave lengths. Give the Government a private right of way from 600 to 1,600 meters, as they now have, and another range from 5,000 to 7,000 for high powered stations and compel them to work within those limits during times of peace. Let the commercial companies have the rest and the art can go on and develop.

Third practice for operators. The third principal point urged by the Navy, as a reason for Government ownership, is the need of practice for their operators. I believe it will not be disputed by any of the commercial companies nor even the amateurs, that the Navy operators need practice. We do contend, however, that the

stopping of the progress of the art, such as would surely result from Government ownership, is too great a price to pay for the Navy's practice, particularly when there are other ways in which the Navy can secure practice for their operators. If it is essential that the Navy operators engage in the handling of commercial messages instead of simply "dummy" or practice messages in order to be efficient, why isn't it equally as necessary that the Navy gunners shoot at real ships with people aboard?

Receiving is the most difficult part of an operator's duty and they can now sit and copy all of the Commercial Co.'s messages if they desire and so get all the practice that they would get in receiving the same messages if they were regularly handling them. The other duties are all such as could be drilled into the operators by station practice, without actually sending any radio messages at all and there is no valid reason for not utilizing such methods and thus securing all the drill and practice necessary to produce first-class operators.

The Navy operators need practice in receiving under abnormal conditions, such as might be expected in war, with guns thundering and enemy operators trying to interfere with their reception of messages. Such conditions could be produced best artificially and would be much better practice for them than the proposed quiet non-interfering and specially regulated peaceful conditions proposed in the bill.

In addition to the above discussion of the three main reasons, given by the Navy Department, for urging Government ownership, certain other questions have been raised at the hearing, which need a reply.

Commander Todd stated, as his opinion, that a fair valuation of all the commercial wireless companies' coastal and high powered stations would not be in excess of \$5,000,000. Where does Commander Todd get his information. One would think that he valued only twisted wires, tables, and steel masts in arriving at such a figure. Surely ideas as set forth in patent rights are worth something. Are the pioneers in this art who have devoted years of their lives and millions of dollars in bringing the art to where there is now some chance of securing some reward to be deprived of all opportunity of securing it? Is the greed for power of a few Navy officers, and I may add that this display of greed has not been confined to the present administration, to be allowed to stifle these developments. It is developments of this kind that have made America great.

The telephone was invented in this country and was developed by commercial interests, while abroad it has been largely a Government monopoly. Compare the developments in that art here and abroad. Compare also the service rendered by the two types of monopoly and you will find America far ahead in every particular.

The wireless was started abroad and soon fell into the hands of the Governments with the result that the developments of the art have been made in this country.

What is \$5,000,000, as a price to pay for such good will and rights? The Marconi Co. alone have a paid in capital of twice that—ten times \$5,000,000 would not be enough.

Regarding the question of the effect on the art of a Government monopoly of wireless, I quite agree with the opinion of the Commissioner of Patents Ewing as expressed by him before this committee. He is absolutely right in all of his opinions expressed on this particular question. I believe the popular opinion that most of the big corporations have many patents lying in their vaults, suppressed, in order to keep their present products on sale (though supposedly inferior to the suppressed patented article) is absolutely wrong. An experience of eight years with the Westinghouse Electric Co. in their engineering and research departments and my knowledge of what other large companies are doing, leads me to that conclusion. All of the big companies are looking for improvements and will pay for and use them if they really are improvements.

The Navy and other Department officials show a lamentable lack of imagination or foresight when they jump to the conclusion that wireless has but one useful field, i. e., between ships or ships and shore. Their talk of developing the art if left to them, shows conclusively what would happen.

Wireless is here to stay and will develop and find many applications not now thought of if only given a chance. If killed by the proposed legislation, the most promising competitor of cables and wire lines will be eliminated.

The Navy and War Departments can see only the military utility of this wonderful invention. That is but a small part of its value. It is essentially an implement of commerce for use in times of peace. If, then, the Government is to take it over, it belongs in the Post Office Department.

One can best judge of what the Government monopoly would mean to the wireless inventor by looking over what has been done in the past and what in fact is being done right along now every day.

All those remarks about "the Navy being the biggest and best customer," "the Navy the market for the inventor's devices," "the Navy encourages the development of the radio art," "the Navy pays royalty to inventors," etc., appeal particularly to those inventors who have come in contact with the Navy.

Our company had a patented detector which was considered the best at the time it was brought out. The patent was sustained by the courts and all infringers enjoined from further manufacture. The Navy purchased from any and all infringers until the courts stopped the manufacture by fining one of the infringing companies. The Navy still refused to purchase from the rightful owners, and when unable to buy elsewhere they manufactured a large number of the devices in their own shops. At that time there was no relief for inventors by suit in the Court of Claims, and there was nothing for them to do but sit and see themselves robbed. Congress later attempted to prevent such acts and passed a law entitled "For the further protection of inventors." This law makes it possible for inventors to sue the Government in the Court of Claims for the recovery of a reasonable compensation for the use of their inventions. This promised well, but has been frightfully distorted by the rulings of the courts, acting no doubt in good faith but under mistaken ideas of urgent military necessity as urged by the Navy Department officials, either by direct correspondence with the courts by letter or

telegram or by having a representative of the Department of Justice urge an exception in the injunction about to issue which would permit the defendant to continue his infringing acts and supply the Government.

Our company secured injunctions against two defendants, but each of these injunctions excepted dealings with the Government, as the court was led to believe by the statements of the Navy Department that irreparable damage would result from their interference with the infringer carrying out his contract in spite of the fact that our company offered to furnish the apparatus and guarantee it to fulfill the conditions imposed.

One of these defendants later entered into an agreement with the Navy Department whereby in exchange for license rights under all of the defendant's patents and a release from damages for all claims of past infringement they (the Navy Department) would furnish them with all of the evidence in their possession to attack the patent. At the trial the Navy Department furnished some 25 or 30 men, most of them in uniform, a most unusual procedure, and had these men testify to the sound of certain sparks they had heard 10 years before with nothing but recollection upon which to base their testimony. A contemporaneous report made by one of the best known Navy officers, the chief expert of the radio service at that, in response to a request from the bureau for an investigation of the character of a certain ship equipment, about which the witnesses at the trial testified at great length, stated just the opposite of the many witnesses.

The report was secured by our company only through the knowledge of its existence by another defendant who had been offered the same agreement of exchange of testimony for license rights and release from damage claims. This last-mentioned defendant declined to make such an agreement and sought to secure possession of the evidence by court order. The court was unable to compel the production of the evidence as the department immediately said it would be against public policy and would reveal certain military secrets. They said that in spite of the fact that the department was on record in letters and telegrams offering to make the agreement of exchange.

Another case is one in which the Marconi Co. sought to stop an infringer from supplying the Navy with apparatus that was an infringement of one of its adjudicated patents. Strange to say, the infringer claimed that the law which had been passed "for the further protection of inventors" gave the Government a license under all patents and the patentee's remedy was a suit against the Government in the Court of Claims. The defendant was given all the assistance possible by the Government and the court found in accordance with defendant's claims and actually dismissed the bill and would not allow an accounting against the infringer. The Court of Appeals affirmed the lower court's decision, and now we have the ludicrous situation of a law passed to protect an inventor being construed so as to facilitate robbing him. Before it was passed infringers could be stopped, now they can't. Anybody can make a patented article and sell to the Government without any liability for damages. The Government becomes a "fence" in assisting thieves in robbing inventors of their rights. Can you imagine anyone spending time and

money in devising, or perfecting, apparatus for which a Government department is the only customer—the “biggest and best” customer as Capt. Bullard said, when the instant such device is completed the Government will buy one, write a detailed specification by copying it, and ask for bids from anyone and then give the order to the lowest bidder?

Can anyone with knowledge of the above conditions, and they are all facts, most of them matters of court record, imagine that the Government monopoly in radio would supply the inventor and investigator with a good market for his wares?

Can anyone with knowledge of the above think that ample provision has been made in the bill to encourage invention and development of wireless apparatus?

I contend then that Government ownership of radio means its death, or at least it will stay at its present stage of development.

In conclusion I will say that if Congress deems it wise to have a Government-owned radio monopoly in order to (a) maintain a kind of neutrality, the necessity for which is not recognized by international law, or (b) to prevent alleged interference between stations, the existence of which is now caused by a foolish regulation requiring the use of but one wave length and is willing to sacrifice the art and the many years of labor of those who are responsible for what we now have, as it is mostly due to American brains, then pass the law; but some consideration should be given the inventors, investigators, and investors, and a liberal amount appropriated for the purpose of paying for what is taken.

I was asked recently by a prominent man the following question: “Who are the people responsible for the development of this country?” I immediately started to think of the large capitalists, the bankers, and railroad magnates, etc., but before I could answer he said: “It’s the suckers who dig down in their pockets and take a chance on some speculation about which they know nothing.”

He is right, and the suckers who have dug deep in their pockets to perfect this wonderful art should be given a chance.

The CHAIRMAN. Mr. Kintner, you appeared before this committee when the original radio law was under consideration?

Mr. KINTNER. I did; yes.

The CHAIRMAN. You were just as bitterly opposed then as you are now?

Mr. KINTNER. I was not quite as much opposed, I think. I think I am a little stronger now than I was then.

The CHAIRMAN. What do you say about that law and its operation, now?

Mr. KINTNER. I think that law is responsible for the interference which exists now and which you are trying to pass another law to prevent. That law compelled all the commercial coastal stations and the ship stations to work on one wave length, put us all on one wire, so that we must interfere. That law is responsible for that.

The CHAIRMAN. But I think at that time you said you were about to perfect some invention that would prevent interference.

Mr. KINTNER. You can not prevent interference when they are all put on the same wave length.

The CHAIRMAN. But you argued and your stout insistence was that if we would just let you alone you would perfect your invention

and that we would have the use of it; otherwise we were going to stifle development.

Mr. KINTNER. That is my contention now.

The CHAIRMAN. How are you getting along with your invention?

Mr. KINTNER. First class. The Navy has a thousand of them in use, and we have been paid for the first three.

The CHAIRMAN. Does that prevent interference?

Mr. KINTNER. It does.

The CHAIRMAN. In what respect?

Mr. KINTNER. It is based upon a principle somewhat different from the tuning; that is, the waves come in from the transmitting station at a frequency, we will assume, of 1,000 per second, and another frequency is set up at the receiving station of 99,000 per second. These two frequencies are superimposed on each other, and as a result of that there is a frequency of 1,000 per second that is heard in the telephone receivers. Now, then, any other frequency except 99,000 or 101,000 would, if heard at all, produce a note at a different pitch, but there would be no confusion resulting, and if we were a very short distance away from either of those lengths they would not be heard at all.

The CHAIRMAN. Does the Marconi Co. use this instrument?

Mr. KINTNER. The Marconi Co. uses some of them; yes, sir. They are licensed under our patents.

The CHAIRMAN. What is all this complaint, then? There seems to be a universal complaint of interference as between these stations erected near each other.

Mr. KINTNER. I think you are misinformed in reference to interference, sir. I think the matter of interference has been grossly exaggerated. It is not the experience of our company that there is any interference which is at all serious.

The CHAIRMAN. You do not regard it as existing at all?

Mr. KINTNER. I do not say that it does not exist at all, and I know some does exist because we are all compelled to work on the same wave length. But through the perfection of traffic arrangements and organization, we have been able to reduce the time of transmitting and to work out a system by which we interfere with each other to the minimum extent.

The CHAIRMAN. You mean all the instruments could work at once, and with perfect harmony, with the absence of interference, if they used your instruments; is that it?

Mr. KINTNER. I do not contend that they must use our instrument only, sir.

The CHAIRMAN. Is there any other instrument that prevents interference?

Mr. KINTNER. There are possibilities of other instruments; yes, sir. This is not a matter where we can just go into a big establishment and secure an instrument that will be guaranteed to suppress interference.

The CHAIRMAN. So far, you are the only one who has appeared before the committee and suggested that the present law is not wise and working very well. I was just wondering what specific reasons you have.

Mr. KINTNER. The only suggested change I would make in the present law would be the one of the wave length. I think you will find—if you examine my remarks of the last time—you will find my contention on that at that time was the same. And I still contend that given some selection of wave lengths, we will work out a satisfactory operating system.

On the matter of distress calls, as to restrictions, and so forth, we have no complaint to make on that. We have never made one.

The CHAIRMAN. What is your suggestion about the wave lengths?

Mr. KINTNER. I would make a reservation for the Government departments from 600 to 1,600 meters. That is what is provided for in the international convention now, and in the present radio law. And then I would like to give them a second range of from 5,000 to 7,000, and I would like to compel them, in addition to that, to stay within those ranges. They are now working any place. You can find them below 600 or above 1,600, more frequently than you can within the range between 600 and 1,600.

The CHAIRMAN. Why do you want to confine the Government to any particular range? Why should they not have the same range as the commercial companies?

Mr. KINTNER. I am simply suggesting dividing the range, of reserving a certain choice range for the Government.

The CHAIRMAN. Why is there any necessity for that if there is no interference?

Mr. KINTNER. There is interference now because the Government can run throughout any wave lengths.

The CHAIRMAN. Could not the commercial companies do the same thing, in the absence of statutory regulation?

Mr. KINTNER. Yes, sir; but there is a statutory regulation which places us on one wire.

The CHAIRMAN. Suppose that was eliminated? That is your contention, that it ought to be?

Mr. KINTNER. I do not get your point.

The CHAIRMAN. I say your contention is that limitation ought to be removed.

Mr. KINTNER. I do contend that; yes.

The CHAIRMAN. Very well; then why not remove it entirely and let the Government and the commercial stations all use any wave length they please?

Mr. KINTNER. That is all right. I think that would be all right. Our company would be willing to have it.

The CHAIRMAN. That is your notion of what ought to be done?

Mr. KINTNER. Yes; our company would be willing to have that.

Mr. HARDY. I do not understand why, if you think with perfect freedom to all parties there would be no interference, you think the Government ought to have a reserved line and be required to stay within that.

Mr. KINTNER. I was just offering that as an alternative. That is, if the Government wants a reservation, they will have certain limits within which they desire to work, and in which they can always find freedom from interference of the commercial companies, because they will have a certain range, and let them work in there and let the commercial companies work outside of that range.

Mr. HARDY. Oh, but if there is no interference, what objection have you to allowing the Government to go outside of that range? Why do you say they should be confined to that range if there is nothing in the division of the ranges?

Mr. KINTNER. Because at present the commercial companies are working on 600 meters only. The Government goes in on 600 meters about as often as on any other wave length; it gets over onto our one wire and causes interference. But we can not go on anything else; we can not go on anything except that one line we now have, but they can go any place. And if they want to avoid interference, and if with exclusive periods they do not get the best results, then the ideal thing to do is give them a particular range.

Mr. HARDY. I do not know that I made myself plain. I understood you to say, first, that if all parties would be given an unlimited range there would be no possibility of interference.

Mr. KINTNER. I would not say no possibility. It is not my intention to convey that idea, at least, because people can interfere maliciously, or through ignorance in the manipulation of the apparatus.

Mr. HARDY. You make the point there of interference by design.

Mr. KINTNER. Certainly.

Mr. HARDY. But if both parties were trying to avoid interference, as soon as they found somebody else on a particular wave length, they would get on another.

Mr. KINTNER. They would get on another and avoid a busy wire, and get on one that is not busy.

Mr. HARDY. But there are millions of wave lengths?

Mr. KINTNER. There are.

The CHAIRMAN. You stated in your former hearing:

We have been engaged for a long time in working out a definite system of interference preventors, and we feel that we have very nearly reached the goal, and when we have reached that goal, it will be possible by the use of selected wave lengths for the systems to be operated in great numbers without interference.

Now, what advance have you made since that time?

Mr. KINTNER. We have perfected since then what is known as the heterodyne selective system. That is a system used both by the Tuckerton and Sayville stations in their trans-Atlantic operations, and it is used in large numbers in the United States Navy. And by its use they are remarkably free from interference by extraneous signals from other stations. I think it is generally acknowledged to be the most nearly perfect receiver of the day.

The CHAIRMAN. Who will you have next?

Mr. GRIGGS. I will ask Mr. Armstrong to make a statement to the committee now.

STATEMENT OF MR. EDWIN H. ARMSTRONG, ELECTRICAL ENGINEER AND SPECIALIST IN WIRELESS RECEIVING APPARATUS.

Mr. GRIGGS. What is your business, Mr. Armstrong?

Mr. ARMSTRONG. I am an electrical engineer who makes a specialty of wireless receiving apparatus.

Mr. GRIGGS. Have you made any inventions or discoveries in that field?

Mr. ARMSTRONG. I have invented the regenerative audion receiver, which is the best interference preventor that is known at the present time. It is used throughout the world in commercial and Government stations.

My particular interest in this legislation began several months ago, when I was asked by one of the Government inspectors at the port of New York to investigate the question of interference between the Wanamaker station and the Brooklyn Navy Yard, when the Brooklyn Navy Yard was receiving signals from Arlington. Now, the conditions of that service are these: The Brooklyn Navy Yard is 2 miles from the Wanamaker station. They desire to receive signals and messages from Arlington, which is 200 miles away from the Brooklyn Navy Yard. The Arlington station operates on 2,300 meters; the Wanamaker station operates on 1,800 meters. That is a difference of wave length of 25 per cent. The power of Arlington and the power of the Wanamaker stations are of the same order. The Brooklyn Navy Yard station can not receive from Arlington while the Wanamaker station is transmitting. That is an established fact. The Government inspectors of the port of New York know that, because the Navy has complained of the interference of the Wanamaker station.

At the request of Mr. Sadenwater, I set up some of my apparatus at Columbia University, which is about 5 miles from the Wanamaker station. I had absolutely no difficulty in receiving messages from Arlington while Wanamaker's was transmitting. I could put the telephones on the table and read the messages from Arlington. In order to hear the messages from Wanamaker's you had to take the telephones up and put them on your ears and then had to wait until Arlington stopped before you could detect they were there.

In order to duplicate the conditions under which the Brooklyn naval station was working, I went over to the Lackawanna Station. The Lackawanna Station is just the same distance from Wanamaker's that the Brooklyn Navy Yard is; that is 2 miles. I took with me a set of amateur apparatus. Part of it I had purchased from amateur manufacturers and part of it I had knocked together myself, and part I had borrowed from amateurs—amateur apparatus. And I set the apparatus up at the Hoboken Station and we received messages from Arlington while the Wanamaker station was sending without the slightest interference. That was witnessed by the Government inspector, Mr. Sadenwater, and by the Marconi engineer, Mr. Elenschneider. I can not understand why the Brooklyn Navy Yard can not duplicate what I did with amateur apparatus, because I know I can pick out at least half a dozen amateurs who can do exactly what I did. And I can guarantee to repeat that 24 hours of the day; I can guarantee that with the apparatus which I used we can receive Arlington on 2,300 meters while Wanamaker's is working and never miss a dot.

The CHAIRMAN. Did you ever try it from the station at the Brooklyn Navy Yard?

Mr. ARMSTRONG. Pardon me?

The CHAIRMAN. Did you ever make the same experiment from the Brooklyn Naval Station?

Mr. ARMSTRONG. No, sir; I have no opportunity to go to the navy yard. I have never been in the navy yard. I have no authority to

make any tests there. It was purely a matter of courtesy on the part of the Marconi Co. to permit me to make those tests at their Lackawanna Station.

The CHAIRMAN. Have you ever requested to be permitted to make the experiment at the Brooklyn Navy Yard?

Mr. ARMSTRONG. Pardon me?

The CHAIRMAN. Have you ever requested permission to make the experiment from the Brooklyn Navy Yard?

Mr. ARMSTRONG. No, sir. I consider that the tests are identical. The stations are the same distance from the interference station; the Lackawanna Station and the Brooklyn Navy Yard are the same distance from the Wanamaker Station.

Mr. GRIGGS. Now, Mr. Armstrong, was there any particular patented device used by you in your tests or experiments which the navy yard does not possess, as you understand?

Mr. ARMSTRONG. I can not say.

Mr. GRIGGS. You do not know?

Mr. ARMSTRONG. I do not know what the Navy use or how they use it.

Mr. GRIGGS. And do you mean to say by that simple device, if it were used by the Brooklyn Navy Yard, all that complaint about interference would disappear, in your judgment?

Mr. ARMSTRONG. In that particular case, which was one of the most flagrant cases of which the Navy protested most violently, in my opinion that interference should not exist.

The CHAIRMAN. Did you use the ordinary apparatus for receiving?

Mr. ARMSTRONG. I used apparatus which is known throughout the country. I have published, in the proceedings of the institute of radio engineers, a complete description of it. In my patent No. 1113149, granted over two years ago, there is also a complete description of it.

The CHAIRMAN. It is a patented device of yours?

Mr. ARMSTRONG. Yes, sir.

The CHAIRMAN. Is it in general use now except by the Navy?

Mr. ARMSTRONG. It is used by license agreements by the Marconi Co., the Atlantic Communication Co., and the Goldsmith Co.—those companies are under license. And the Federal Co., we are negotiating with them now. It is used at the present time by the Federal Co. And it is also used by a great many amateurs throughout the country.

Mr. GRIGGS. By license?

Mr. ARMSTRONG. The amateurs are not licensed.

Mr. GRIGGS. Is it used by the United States Navy?

Mr. ARMSTRONG. Yes, sir; it is.

Mr. GRIGGS. Do they pay you anything for the use of your invention?

Mr. ARMSTRONG. They do not.

Mr. GRIGGS. Have you had any communication with them, any interchange of correspondence? Have you made any claim on them?

Mr. ARMSTRONG. After my patent issued and after I had published my paper, I received a communication from the Bureau of Steam Navigation that stated that the bureau was informed I was the inventor of a certain form of feedback circuit, and they requested information as to what steps they should take to secure the right to

use that invention. I went to Washington and I met Lieut. Commander Hooper. I had quite a long talk with him. He told me, among other things, that the department did not pretend to know anything about patents. He said that it was the policy of the department, if possible, to settle claims of inventors. Then we talked business. I found that the policy of settling with the inventor was to offer him a royalty on the few sets of apparatus which the Government manufactured themselves. They refused absolutely to pay any royalty on the use of the apparatus, whether it was manufactured by the Government or by infringing manufacturers. I had, personally, another conference with Lieut. Commander Hooper, and my attorney or his representative had, I believe, three other conferences. We were up against a stone wall every time of the Government refusing to pay a royalty on any apparatus except that which they manufactured themselves, and then only a manufacturing license. They will not pay a royalty for the use of the apparatus—on the use of such apparatus as is manufactured by infringers and which, by the way, constitutes the greater part of the apparatus which they use.

Mr. GRIGGS. What reason, if any, did they give for taking that stand?

Mr. ARMSTRONG. The main reason that I could discover was that they did not know anything about patents, and even if an inventor had a just claim against the Government he could go to the Court of Claims. They said, incidentally, that they never paid more than \$7,000 for any invention in wireless. That is the only reason that I know of.

Mr. GRIGGS. How many of these valves to which your invention applies are in use by the Government, supplied by outside contractors, so far as you know?

Mr. ARMSTRONG. Lieut. Hooper told me about a year ago that they wanted to use it or were using it in about 40 stations at that time; but I believe the use has been very greatly extended since that time.

Mr. GRIGGS. Have you any litigation or dispute as to the validity of your patents?

Mr. ARMSTRONG. No, sir; that patent was issued over two years ago, and to my knowledge there has been no other claimant in this country.

Mr. GRIGGS. So that the department is not embarrassed by having two claimants for the same invention?

Mr. ARMSTRONG. I do not see how they can be.

Mr. GRIGGS. Is there anything else you wish to say?

Mr. ARMSTRONG. I do not think so.

The CHAIRMAN. Is anyone infringing your patent? Is anyone else manufacturing your device without license from you, to your knowledge?

Mr. ARMSTRONG. Yes, sir; Dr. De Forest has been manufacturing it since he learned of my work.

The CHAIRMAN. Have you taken any steps to stop him? Does he claim to be the inventor himself?

Mr. ARMSTRONG. He does not claim to be the inventor himself. He does not claim to be the inventor of the particular principle on which I have a patent. He claims to be the inventor of one of the

minor improvements, but that case, I believe, will be settled very shortly in the Patent Office. The particular idea he admits he does not claim. That is a matter of Patent Office record.

The CHAIRMAN. The question has not yet been settled in the Patent Office?

Mr. ARMSTRONG. That is another invention which the Government is also using. I have made no statement about the second or third invention on this fundamental idea.

The CHAIRMAN. Are you and Dr. De Forest contesting the right to that invention?

Mr. ARMSTRONG. No, sir; I have got a patent on it. The patent was granted over two years ago. Dr. De Forest has disclaimed in file wrapper of one of his cases that his apparatus was in any way similar to the apparatus to which I have a patent.

The CHAIRMAN. There is no litigation pending between you and anyone else with reference to the infringement of your patent?

Mr. ARMSTRONG. No, sir.

The CHAIRMAN. There is no one manufacturing your patent, or your invention, without a license from you?

Mr. ARMSTRONG. Oh, yes.

The CHAIRMAN. Except the Government?

Mr. ARMSTRONG. No, sir.

Mr. GRIGGS. Where does the Government get these valves which they use?

Mr. ARMSTRONG. The Government buys them from the De Forest Radio Telephone and Telegraph Co.

The CHAIRMAN. Do they claim they are the inventor and have the right to sell to the Government?

Mr. ARMSTRONG. They claim to be the inventors of a particular part of the apparatus—of an improvement or of a different apparatus—but they do not claim to be the inventors of the regenerative circuit on which I have a patent and on which I have had no litigation of any kind.

Mr. GRIGGS. They do not have to claim any right to the patent in order to sell to the Government and not be responsible under the present conditions, as you understand them?

Mr. ARMSTRONG. No, sir; they do not.

Mr. GRIGGS. They have a perfect right to steal your property if they want?

Mr. ARMSTRONG. They have, sir; and I can do absolutely nothing.

Mr. GRIGGS. You can do the same thing—use their patents—if you cared to?

Mr. ARMSTRONG. If I cared to go into that line of business, I could.

Mr. HARDY. As I understand you, you have a right to sue them, but you can not enjoin the Government; is not that it? Can not you sue the De Forest Co. for infringing your patents and manufacturing these things? I am assuming in the argument it was merely a question of injunction.

Mr. GRIGGS. Let me answer that. You will see in this record that I have filed with the committee the circuit court of appeals held that the manufacturing contractor was not even liable to account for profits, and dismissed the bill of complaint.

Mr. HARDY. But the Government, before the Court of Claims, is liable.

Mr. GRIGGS. The Government is liable before the Court of Claims.

Mr. HARDY. Then, I will change the question. Is it any more trouble for you to sue, to prove up your case before the Court of Claims, than it would be in any other court?

Mr. ARMSTRONG. I have never had any experience with the Court of Claims, but my attorney who is handling a Court of Claims case for a very large corporation, the Electric Boat Co., strongly advises me to attempt no suit in the Court of Claims.

Mr. HARDY. Let me just say this: I think we are getting clear out of the line of our proper investigation, but I can not see why you could not bring up your case in the Court of Claims against the Government just as you could in any other court against De Forest; and it seems to me the action you complain of is that the Government says to you to go and establish your claim against the Government in the Court of Claims, which was created for the purpose of enabling private citizens to sue the Government.

Mr. ARMSTRONG. As I understand it, the length of time which it takes to get a case through the Court of Claims and the length of time which will be necessary, which will elapse between the time the Court of Claims rules and the time the money is appropriated by Congress is such that the ordinary inventor will starve before he can get any relief.

Mr. HARDY. Is not that pretty nearly true if you go into the ordinary civil courts? The courts take weeks and weeks to try the case, and then you have to go to the court of appeals and all those delays we have.

Mr. ARMSTRONG. I believe not. It is the opinion of my attorneys that an ordinary suit would be a very clear proposition in my case. It is a clear case.

Mr. HARDY. You have had a different experience from most other sections of the country. I have seen cases drag along for years and years.

Mr. GRIGGS. Judge, if that was the general impression, we attorneys would not have any business, I believe.

Mr. HARDY. It is the general condition in the courts of Texas. A case takes years and years.

Along that line let me ask you a question: You have an invention, and in order to use it you must put it into operation. If the Government did not make that a species of property and give you the right to sue somebody for infringing it, you would be utterly helpless against infringement, would you not? So that your whole patent right is a creation given you by the Government based on your invention, is it not?

Mr. ARMSTRONG. Yes, sir.

Mr. HARDY. Now, do you think it is your right to say to the Government or anybody else that you should be allowed to fix the price on your invention entirely?

Mr. ARMSTRONG. I do not get that.

Mr. HARDY. Do you believe you have the right, by being the preemptor of the idea, the invention, to warn everybody else off of your ground and then say to them, at the same time, "You shall only go on that ground and use my patent by paying me what I dictate"? In other words, you spoke of the Government saying that it paid no more than \$7,000 as a royalty for a wireless patent,

or something of that sort. Do you think it is your privilege to name the price?

Mr. ARMSTRONG. I think so; yes; because—

Mr. HARDY. Would you have anything if the Government had not given it to you? And do you think you should have the right to hold the Government up for any sum?

Mr. ARMSTRONG. Would the Government get the improvement if I did not put up my money and sit up nights to think this thing out?

Mr. HARDY. I do not know whether they would or not. But after you get that, you want to warn everybody else off and do not want anybody else to invent the same thing or to slip in ahead of you. If you can get the entry in there ahead of the other man, by that act you cut him off, and the Government gives you a right; and you think you ought to dictate just what that right is worth to the Government?

Mr. ARMSTRONG. I am perfectly willing to take from the Government what the commercial companies pay.

Mr. GRIGGS. There is not any dispute as to the value of the thing to the Navy. They simply do not discuss price at all. They simply say, "We pay nothing; you go to law."

Mr. HARDY. He said that, incidentally, they spoke of \$7,000.

Mr. GRIGGS. I know; but I do not understand that they discussed price at all.

Mr. HARDY. I do not understand they said they paid nothing; I understand they told him to go to the Court of Claims and establish what it is worth.

Mr. EDMONDS. If you are going to take that stand, then you will prove exactly what these gentlemen have been contending, that there will be no initiative if the Government takes their inventions.

Mr. HARDY. There is so much talk about the Government robbing those people, and they would have had nothing except the Government gave it to them. And yet the most the Government has said is that he must establish his claim in the Court of Claims.

Mr. GREENE. The Government can not give them brains; and if a man has not brains, the Government can not give him anything.

Mr. HARDY. It takes an individual with brains to make an invention, but without the patent laws that invention would be worth nothing.

Mr. GRIGGS. The Government, under the Constitution, has said, "We will give you this to encourage you to invent." Now, what kind of a giver do we call one who gives something and then takes it back, "an Injun giver"?

Mr. HARDY. The Government has never said to this man the expression you gentlemen and this man has been using—that the Government has been robbing him.

Mr. GRIGGS. Excuse me, but I have not used that expression.

Mr. HARDY. He has used it, and I think that has been the current expression since we have been talking along this line. The Government has never said to you that it would not pay you anything, but it has said to you to go and establish your claim in the Court of Claims.

Mr. ARMSTRONG. Yes, sir; they have, and they know what that means.

Mr. HARDY. Do you not know that is a tribunal created by law to enable you to establish your claim against the Government?

Mr. ARMSTRONG. Yes, sir.

Mr. HARDY. Now, because you do not do that, you say the Government is robbing you.

Mr. ARMSTRONG. Because they understand I can not do that.

Mr. HARDY. Why can't you?

Mr. ARMSTRONG. Because I will go broke. I have to make a living.

Mr. HARDY. Is that because the witness fees are so high you can not testify before the court?

Mr. ARMSTRONG. No, sir; I can not pay the lawyers.

Mr. HARDY. Oh, you have some lawyer who will break you!

The CHAIRMAN. I heard a very good lawyer say here, during the recess, just as an example, "If that man has a good case, I would like to take it for a contingent fee for about a third." And you will find any number of lawyers here in Washington who will take care of your case, if you have a good one, and prosecute it before the Court of Claims. That court was created in order that a man might have the opportunity to sue the Government.

Mr. GRIGGS. But you will not let the court pay the judgment?

Mr. EDMONDS. We have had two of those judgments up on the floor, and they will be arguing about them for the next year. That is one of the things they have been talking about; they say they do not know when they are going to get their money. It is usually about 10 years after he gets his judgment before he gets his money, if he gets it at all.

The CHAIRMAN. The Government is a very poor payer; I will say that.

Mr. ARMSTRONG. There is just one point I want to make in connection with this Court of Claims business: while it may be perfectly true that I can get a lawyer to take the case on a contingent basis, on a percentage basis, it will take a great many years before I can get any return. Meanwhile, I have absolutely no means of support; then what am I going to do in the meantime?

The CHAIRMAN. I do not want to be understood as justifying the attitude of the Navy Department for a minute, because you say (and so far it is not contested) that you have a valuable invention which is being used by the Government; that no one is contesting your right as the inventor. And to save my life I do not know why they do not pay you and pay you well for it, and not compel you to go into the Court of Claims, either. That is the way it looks to me on the face of it.

Mr. GRIGGS. I should think, Mr. Chairman, it would be a good thing to ask the Navy Department what their reason is for that.

The CHAIRMAN. I think we will.

Mr. GRIGGS. I wish you would, because it is a public matter and we are all interested in that. And if it is doing an injustice to inventors, I think we ought to know it.

The CHAIRMAN. Yes. I do not think the Government has a right just to take over valuable inventions, and use them, and tell the citizens to "go to the courts now and litigate this matter and determine your rights." They ought to treat them like anybody else, on a contract basis, if they take the invention, and pay a reasonable price for it; and if they can not do that, they should not take it at all.

Mr. EDMONDS. The Government never made any offer at all, did they?

Mr. ARMSTRONG. They never made any offer in figures. They offered to pay a royalty on the apparatus which the Government manufactured for its own use.

Mr. EDMONDS. But they did not want to compensate you in any way for this other apparatus which they purchased?

Mr. GRIGGS. No. But that was a very small amount, you understand.

Mr. ARMSTRONG. No, sir; they did not.

The CHAIRMAN. Is there anything else? If not, who will you have heard next?

Mr. GRIGGS. Mr. De Sousa, who is the traffic manager for the Marconi Co.

**STATEMENT OF MR. GEORGE S. DE SOUSA, TRAFFIC MANAGER
MARCONI WIRELESS TELEGRAPH CO. OF AMERICA, NEW YORK,
N. Y.**

Mr. DE SOUSA. Mr. Chairman and gentlemen, I fail to observe in the testimony given by the supporters of the proposed act, any evidence that the present commercial stations have failed to properly conduct commercial wireless telegraph business, nor has any evidence been produced by the supporters of the bill showing that existing commercial radio stations are not fully and adequately equipped to handle satisfactorily all commercial wireless telegraph traffic. On the contrary, I have proof showing that where the Government stations have attempted to handle commercial business they have not done so as satisfactorily as the commercial stations, and my experience in the wireless telegraph business, which dates over a period of 13 years, has convinced me that commercial operation by naval stations in the past has been far inferior to the service rendered through commercial stations, and I have no hesitancy in stating that, should all commercial business be handled through Government stations, the service would suffer materially, to the detriment of shipping and the public in general.

One of the strong reasons against Government operation is the fact that Government operators are not chosen in the same practical manner as are commercial operators; and further, the inducements of Government employment are not as attractive to practical telegraph men as those offered by commercial institutions.

I have read the minutes of the testimony given by the gentlemen appearing in favor of the bill and have sought for any evidence showing what the Government could do in times of war or national disaster, if it owned the coastal stations, that it is not able to do under the existing radio law, and nowhere have I found any explanation of this.

I desire to respectfully direct the attention of this committee to the act of August 13, 1912, which, in section 2, reads:

The President of the United States, in time of war or public peril or disaster, may cause the closing of any station for radio communication and the removal therefrom of all radio apparatus, or may authorize the use or control of any such station or apparatus for any department of the Government, upon just compensation to the owners.

Is this not sufficient power? Is it not all embracing? Certainly it must be evident to this committee that with a free scope for commercial development and personal initiative the maximum state of development is attained in times of peace; then, in times of emergency, the trained personnel, the developed stations, the plants, inspection depots, factories, machinery, and a multitude of other items which comprise a successful wireless telegraph industry are at the disposal and immediate call of the Government.

Moreover, the present European war has already demonstrated the complete feasibility of the Government exercising just such authority as is now vested in the hands of our President, and to which I have previously referred. The United States Government is now operating the Tuckerton station, and likewise the Sayville station, belonging to commercial organizations. As a matter of fact, has not the Navy Department been assisted by the presence of the commercially trained experts at these stations; and if not, why are these commercially trained experts allowed to remain at these stations, now that the Government has authority to operate them?

The supporters of the bill have pointed out the importance of censorship, and have claimed that by Government ownership and operation of coastal stations a more rigid censorship can be maintained. In the first place, let me assure you that the Marconi Co., for one, does not object to a proper censorship, but does protest against the existing lack of censorship which has forced upon the Marconi Co. responsibilities properly belonging to the Government, as I will show by facts in my possession. In the first place, the Government has refused, despite our earnest request, to furnish sufficient censors for our stations; in fact, at most of our stations there is no censor at all, yet the same regulations apply at such stations as at stations where censors are stationed. At none of the Marconi stations is more than one censor supplied, yet certain stations must be open to commercial service, in accordance with public requirements, 24 hours a day, during which time they can not refuse to handle business offered them.

The delay to shipping and the poor wireless service rendered the public by American stations during the existing hostilities are directly chargeable to the censorship regulations of the Navy Department. So much confusion exists that hardly any two of the Government censors themselves agree as to the proper interpretation of the regulations.

The present censorship facilities, in so far as the Marconi Co. is concerned, to quote the expression of a high Government official, amount only to "post-mortem" censorship. When I say that at practically all of our stations the censor on the following day looks over the preceding day's traffic the meaning of the foregoing expression will be evident to you. Notwithstanding our earnest request to the Navy Department that an adequate censorship be provided, our request has been denied, and we have been informed by the Secretary of the Navy that if any of our stations transmit any message which the Navy Department may consider to be of an unneutral character all of our stations will be closed until the conclusion of the present European war.

In order that this committee may be informed as to just what the Marconi Co. has had to contend with in connection with the Navy Department's neutrality regulations I will now read certain corre-

spondence exchanged between the Secretary of the Navy and the Marconi Co.

This letter is dated Washington, October 12, 1916, addressed to the Marconi Wireless Telegraph Co. of America, Woolworth Building, New York:

GENTLEMEN: The department is informed that about 6.29 p. m., October 7, 1916, your Sea Gate station sent the following message to the commander of the steamship *Alaunia*:

"Boat reported arriving this afternoon sailed two hours later. Signed, Cunard."

From the wording of this radiogram, time of transmission, and all other circumstances, the department is convinced that the transmission of this message was an evasion of the President's neutrality proclamation and of the neutrality regulations of this department.

From your experience in connection with the closing of the Siasconsett station in 1914, from correspondence, and from conversations between your officials and officers of this department, the department is convinced that your company thoroughly understands that it is responsible for unneutral service irrespective of the presence or absence of a censor.

In case of another such violation of the neutrality of the United States, the department will take steps to close all shore radio stations operated by your company on United States territory, and to prevent their being reopened until the conclusion of the present European war.

The department requests that you acknowledge receipt of this letter, furnish such information as may be available concerning the message quoted in the first paragraph above, and state your future policy.

Very respectfully,

(Signed.)

JOSEPHUS DANIELS.

The CHAIRMAN. What was that message?

Mr. DE SOUSA. It was a message sent to the commander of the steamship *Alaunia*, on the 7th of October, reading:

Boat reported arriving this afternoon sailed two hours later. Signed, Cunard.

On the 16th of October, I replied:

SIR: Referring to your letter of October 12, which calls attention to the sending of a message from our Sea Gate station to the commander of the steamship *Alaunia*, on October 7th, as follows:

"Boat reported arriving this afternoon sailed two hours later. Signed, Cunard."

We would respectfully advise you that we have made inquiry and investigation of the circumstances connected with the sending of this message, and find the facts to be as follows:

At the time that the operator at the Sea Gate station received for transmission this message, he had not heard any report of the arrival of any German submarine in our waters and was entirely unaware that the message could in any way relate to such vessel. He transmitted the message in the usual course in entire ignorance and innocence of its purport. At the time the message was received the censor of your department was not present. On the 9th of October the censor visited the station and looked over the messages which had been sent and passed this particular message without any comment. In the light of these circumstances it is apparent that no blame is attachable to this company for the sending of this message.

We think it important in this connection to call your attention to the possibility of messages of this kind, which do not in themselves disclose any circumstances indicating an unneutral purpose being transmitted in ignorance of circumstances which might, if known, prevent their being forwarded. This company has kept a very strict watch for all traffic that would be considered by your department as unneutral and has forwarded nothing as to which even a doubt could be suggested. In view of the severe attitude you assume with reference to any future violation of the regulations of your department, and in view of the fact that your department does not provide sufficient censors to enable us to submit before sending all messages for the approval of the censor,

we suggest that in order to protect us from unmerited blame, a sufficient number of censors be supplied to our stations to examine and pass on all messages filed for transmission speedily and promptly before the same are sent. Only in this way can such unavoidable and unintentional incidents as that of the message in question be absolutely avoided.

We wish to reaffirm our desire and efforts to comply with the regulations of your department, and are sure that the censors who have been present at our stations will confirm our assertions that in all respects we have endeavored to comply absolutely with the spirit of the regulations.

Respectfully, yours,

G. S. DE SOUSA,
Traffic Manager.

Mr. HARDY. Let me make a suggestion. It seems to me that we are getting clear out of the field of the desirability or the undesirability of this legislation and going now to a question of the administration of the neutrality laws between wireless operators and the Navy Department, and if we go into that field we will probably be here when the snow flies.

Mr. DE SOUSA. Well; the bill, Judge, touches neutrality. I think it is important to bring to the attention of the committee just in what manner the question of neutrality in connection with radio apparatus and operators is involved.

Mr. ROWE. Practically every one of the witnesses has touched on the question of neutrality, and that is why it is important.

Mr. HADLEY. I think one witness testified to a specific breach of neutrality.

Mr. ROWE. On this very message.

Mr. DE SOUSA. Yes. On the 18th of October I received from the Acting Secretary of the Navy, Franklin D. Roosevelt, in response to my letter, which reads as follows:

GENTLEMEN: The receipt of your letter of October 16, 1916, in which you disclaim any responsibility for the transmission of any unneutral message to the steamship *Alaunia* by your Sea Gate station on October 7, is acknowledged.

The department does not share your views in the matter as detailed in your letter. A message in violation of the neutrality of the United States was in fact permitted to pass through one of your stations, due solely to the failure of your company to take adequate means to prevent such unneutral service; this in special circumstances which would indicate that the strongest steps should be taken.

Your suggestion that a sufficient number of censors be placed in your station to pass on all messages promptly is not practicable. The department will, if necessary, carry out its duties in connection with the radio neutrality of your stations by the only effective means at its disposal, namely, the closing of the station.

The general attitude of your company toward the neutrality regulations reaffirmed in the last paragraph of your letter is noted with satisfaction.

Respectfully,

FRANKLIN D. ROOSEVELT,
Acting Secretary of the Navy.

I have been informed by one of the naval officers who is responsible for the enforcement of the Navy Department's censorship regulations that the reason our request for adequate censorship is not granted is because, in the opinion of the Navy Department, the Marconi Co. and its operators are better able to act as censors than any officers which the Navy Department may be able to supply for the purpose, and the naval officers' opinion as to the superior censorship ability of the Marconi operators is well founded, as is

evidenced by the fact that on October 8 the United States naval radio station at Newport sent the following message broadcast:

The *Stephano* has just sent S O S and says she has been torpedoed by a German submarine off Nantucket

On October 9 the following messages were sent from the U. S. S. *Balch* by passengers picked up from the *Stephano*:

Stephano sunk by submarine Sunday evening, 10 p. m., off Nantucket Lightship. All safe. Wire later.

Ship sunk by submarine 10 p. m. Sunday evening. Landing Newport. Will arrive New York Monday.

On October 8, 1916, the following press dispatches were sent out by the Arlington radio station:

Boston, Mass.—The proximity of the German submarine warfare to American shores, which has been a subject of speculation within the past few days, was confirmed yesterday when news arrived in this city via radio stating that a German U boat is ravaging ships off the New England coast. Seven steamers have either been sunk or badly crippled off Nantucket Lightship. A flotilla of American destroyers rushed to the scene in response to calls for aid being flashed out and were kept busy all night picking up the crews and passengers of the stricken ships. Four British and one Norwegian and one Dutch ship are definitely known to have been sunk in the first day's operation. No known loss of life has yet been reported. The submarine is believed here to be the same one that called at Newport Saturday. Panic exists among Boston shippers. The crew of the *Kingston* is missing.

There are other items in addition to what I have quoted.

In accordance with the Navy Department's censorship and neutrality regulations the messages are unneutral. Had the same messages been transmitted by a Marconi station the Navy Department's threat of closing all Marconi stations would probably have been enforced.

A member of this committee has very pointedly stated that if any violation occurs it is less dangerous if such violation be committed by a commercial company rather than by the Government of the United States itself.

Gov. Griggs, the president of my company, has practically covered that same subject in his address this morning.

The service performed by the high-power stations of the Marconi Co. has, from the very first, been of inestimable value and benefit to the public. The rates charged for the service rendered by these stations are considerably lower than the existing cable rates. On the Pacific coast, where the Marconi Co. inaugurated service between California and Hawaii in competition with the Commercial Pacific Cable Co., the following classes of service were established:

Ordinary or rush messages, 25 cents per word. One-half that rate for Government messages. Wireless letters, 13 words for \$1. Weekend letters, 25 words for \$1.50. Press messages, day rate, 10 cents per word; night rate, 5 cents per word.

Prior to the opening of the Marconi stations for public service, the cable had but two classes of service—one for ordinary messages at 35 cents per word, and the other for press messages at 15 cents per word. As the result of the successful operation of the wireless circuit, the cable company reduced its rate for ordinary messages to 25 cents per word and has established a deferred service at one-half that rate. The Marconi Co. on November 15, 1916, extended its service from the United States to Japan, relaying its messages via our

station at Kahuku, on the Island of Oahu. The rate from San Francisco to Japan charged by the Marconi system for ordinary or rush messages is 80 cents per word and one-half that rate for United States Government messages. The Marconi Co. has also established a deferred service at 40 cents per word, as against the cable company's rate of \$1.21 per word from San Francisco, and then only one service, the press service.

The successful development and operation of the high-power stations owned by the Marconi Co. has given to the American public a vastly cheaper means of communication than that previously afforded by the cable companies.

Existing United States and international regulations governing radio communication are in my opinion adequate for the proper execution of wireless telegraph business on the part of commercial interests, and such limitations as exist are not ascribable to legislation but the limitations of the art itself, which is being rapidly improved. When the technical limitations which the other gentlemen present have discussed are eliminated, I am confident that the radio art will reach its highest state of perfection under private control, and will equal that state of perfection which has been reached by the telephone and telegraph organization of the United States, a grade of perfection much higher than that reached through the development, or rather undevelopment, of the telephone and telegraph under Government ownership in Europe.

Mr. GRIGGS. Can you tell the difference in compensation between the different grades of operators, paid by the Government and by the Marconi Co.?

Mr. DE SOUSA. I have been informed, Gov. Griggs, that in the Government service the operators receive a maximum of \$60 a month, with quarters. Whether that is so or not I really am not prepared to say. I think the Navy gentlemen will be able to furnish the committee with that information. But in so far as the Marconi Co. is concerned, we pay our shore-station operators anywhere from \$60 to \$125 a month, with quarters.

Mr. GRIGGS. Does the Marconi Co. also maintain a school?

Mr. DE SOUSA. The Marconi Co. maintains schools of instruction and trains its operators and chooses its operators with the greatest care and exercises judgment in their selection.

Mr. GRIGGS. Does it also insure their lives?

Mr. DE SOUSA. The Marconi Co. of America insures the lives of all its employees.

Mr. GRIGGS. For their benefit?

Mr. DE SOUSA. For their benefit; for their exclusive benefit, and the company pays all the cost of insurance. We pay our operators on shipboard from \$30 to \$60 a month, food and lodging.

The CHAIRMAN. They are mostly young men, are they not?

Mr. DE SOUSA. Yes, they are mostly young men. I should say the average age of our ship operators is in the neighborhood of 25 years.

The CHAIRMAN. There is a suggestion here that this bill should be amended so as to limit the age to 19 years.

Mr. DE SOUSA. Well, as a matter of fact, we employ no operators less than 18 years of age, and we employ only American citizens, too.

Mr. GRIGGS. I will call Mr. Sarnoff, who is one of the officers of the Marconi Co., and he will be the last witness on the part of the

Marconi Co., except I would like to have in the record the letter of Prof. Goldsmith, which Mr. Sarnoff will read.

STATEMENT OF MR. DAVID SARNOFF, COMMERCIAL MANAGER OF THE MARCONI WIRELESS TELEGRAPH CO. OF AMERICA, 233 BROADWAY, NEW YORK CITY.

MR. SARNOFF. I am commercial manager of the Marconi Wireless Telegraph Co. of America. I have been connected with the Marconi Co. for the past 10 years, during which time I have been employed in every department of the company. I am also secretary of the Institute of Radio Engineers. In reading over the testimony of the proponents of this bill I have been particularly concerned with the interference feature of the bill. I want to confine my remarks to that particular problem. Prof. Pupin has testified this morning scientifically as to interference matters, as to the different interferences produced by various elements. Mr. Kintner, who testified this afternoon, spoke about certain wave length differences and the practical operation of those wave lengths.

I want to say a few words to your committee from a purely practical standpoint. So far as interference is concerned, it consists of several elements. First, the apparatus itself. Next, the operators who operate the apparatus. Third, the traffic system by which the operators and the apparatus send and receive messages. Under the regulations of the present law the commercial companies have the right to use 600 meters or less. Now, when I say less I do not mean that the companies have very much choice, because they are practically limited to 600 meters. This is a very limited range of use; from 300 to 600 is all they can use, and on some ships these wave lengths are not very efficient. The commercial companies have the right to use wave lengths above 1,600. Between 600 and 1,600 is what we radio men call the cream. The cream is reserved to the Navy. It has been testified that the Navy Department has the right to use any wave length for any purpose. Now, is it not singular that, despite the limited choice which the commercial companies have in respect to wave lengths and despite the fact that they have to conduct the greatest part of the work, nevertheless the Navy Department, with full scope to use any and all wave lengths for any and all purposes, and with very limited traffic in transmitting and receiving, says that it must have everything, that it must have the coast stations of the commercial companies as well as its own, while the commercial companies are not complaining?

I have been a wireless operator and employed at some of the busiest stations in the world. I have handled a great deal of traffic. I have been for two years operator at the Wanamaker station in New York. During the two years that I have operated between New York and Philadelphia at the Wanamaker station I have handled as much as 50 or 60 messages an hour, and during that time I have not even heard the navy yard in Brooklyn, which is only 2 miles away, unless I wished to hear them. If I wanted to communicate with Philadelphia, I pushed a button and sent the message, and at the same time the navy yard was unable similarly to communicate with its naval station in Philadelphia. What I say in regard to the New York end of the Wanamaker circuit is equally true of the Phila-

delphia end. That is a condition which exists, and to my mind is accounted for only by the lack of efficient operators on the part of the Navy. It is known by all radio men—and I think if they will speak frankly and sincerely they will bear me out—that the Navy operators are not anywhere near as efficient as the commercial operators. Now, I am not reflecting on the Navy, because there are good and sufficient reasons why that is so. In the first place, the commercial companies put their operators through a special course of training. They want telegraph operators, not scientists. We do not pay any attention to the question of technical knowledge, so far as a busy wireless telegraph shore station is concerned. We employ a good telegraph operator. We either take him out of the cable companies or the telegraph companies or we train them ourselves along special telegraph lines. When we place an operator in charge of the key at a busy coast station he is able to telegraph better than he is able to do anything else. In the navy yard, in the Navy Department, that practice does not prevail. The men in the Navy Department receive their positions by assignment. They have to take an electrical course, and I am not deprecating the value of electrical knowledge, but when a man is a wireless operator I say he must be a good wireless operator and not primarily a good electrician. Most of the Navy operators are electricians rather than telegraph men.

New York Harbor is perhaps the busiest seaport in the world, so far as wireless business is concerned. More ships enter the harbor of New York than any other harbor, trans-Atlantic ships which carry many passengers and have many messages to transmit and receive. Before I came to Washington I asked the manager of our Sea Gate station at New York Harbor to tell me what is the condition at Sea Gate now in regard to interference, and I received from him a short letter, which, with your kind permission, I will insert in the record:

MARCONI WIRELESS TELEGRAPH CO. OF AMERICA,
SEA GATE RADIO STATION,
New York Harbor, N. Y.

Mr. DAVID SARNOFF, *Commercial Manager.*

Marconi Wireless Telegraph Co. of America.

DEAR SIR: I understand that a number of the gentlemen testifying before the Committee on Merchant Marine and Fisheries, in Washington, in connection with the proposed bill entitled "An act to regulate radio communication," have stated that considerable confusion exists at present in the atmosphere when radio stations located at important seaports endeavor to transact business to and from ships at sea.

I have been a wireless-telegraph operator since 1903, and since then have been employed in the capacity of wireless operator and manager of ship and shore stations equipped with Marconi apparatus, and for the past five years I have been in charge of the Marconi station located at Sea Gate, New York Harbor.

The Sea Gate station probably exchanges more traffic with ships at sea—and by that I mean sends and receives more messages—than any other marine radio station in the world. There have been days when the Sea Gate station has handled upward of 300 wireless messages, all of which were exchanged between the Sea Gate station and ships in New York Harbor and the vicinity with promptitude and without delay, and I do not know of a single instance where the Sea Gate station has failed to dispose of any wireless message because of interference.

The operators at my station find no difficulty in communicating with ships at sea at the same time that the Wanamaker station in New York is transmitting to Philadelphia. However, ships at sea communicating with Sea

Gate have in the past complained of interference from the radio station at the New York Navy Yard when that station was communicating with other naval land stations, but this interference could have been avoided had the New York naval station transmitted on a different wave length and had the character of the waves emitted by that station been less damped.

Yours, very truly,

CHAS. J. WEAVER, *Manager.*

I also have letters from the general manager of Wanamaker's, in New York, and the chief operator of the Wanamaker station in New York, which I ask leave to insert at this point:

JOHN WANAMAKER,
New York, January 20, 1917.

Mr. DAVID SARNOFF,
*Manager Commercial Department,
Marconi Wireless Telegraph Co. of America, New York, N. Y.*

DEAR SIR: In connection with certain statements made by Government officials appearing before the Committee on Merchant Marine and Fisheries concerning the proposed act to regulate radio communication I desire to state that since September 10, 1911, I have been actively engaged in the operation of radio stations on board ship and ashore; that from August 1, 1912, to August 20, 1916, I was chief radio operator at the Marconi radio station at Sea Gate, New York Harbor, during which time I was assigned for a short period to the John Wanamaker radio station in New York; that since August 25, 1916, I have been in charge daily of the John Wanamaker station in New York, and that during these five years of experience in and about New York I have had every opportunity to closely observe the effect of the working of the John Wanamaker station.

I am therefore qualified to say that at no time, in any circumstances, has the John Wanamaker radio station in New York interfered with the operation of commercial ship radio stations, provided such ship stations were properly adjusted, while carrying on its usual business of exchanging messages with the John Wanamaker station in Philadelphia.

The existing wide difference in wave lengths employed by the John Wanamaker station—1,750 meters—and by commercial ship stations—600 meters—in my opinion obviates the possibility of mutual interference between them in any degree whatever.

Furthermore, to illustrate the ample margin existing between the points of interference of the wave lengths in use, I might add that in my judgment the wave length of the John Wanamaker station could be materially reduced—for example, to 1,400 meters—without danger of interference with the working of commercial ship radio stations.

Respectfully, yours,

G. H. BURGESS, *Manager.*

JOHN WANAMAKER,
New York, January 20, 1917.

DAVID SARNOFF, Esq.,
*Commercial Manager Marconi Wireless Telegraph Co. of America,
Woolworth Building, New York City.*

DEAR SIR: Referring to testimony given by witnesses of the Government before a committee on the Merchant Marine and Fisheries concerning the proposed radio legislation, a statement was made that wireless stations owned and operated by John Wanamaker, communicating between New York and Philadelphia, caused interference to shipping and to many others, we desire to state, that for a period of five years, during which time the stations have been in operation, quick and reliable service has been rendered, and we do not know of a single case where a message filed for transmission over our wireless circuit has interfered with other communications on ships at sea, nor have we experienced any interference from others in transmission of our communications.

We continue the service not only because of its convenience, but because the cost is less than that of a special telegraph wire.

Yours, very truly,

JOHN WANAMAKER, NEW YORK,
PRESTON P. LYNN,
General Manager.

At New York Harbor there is located a wireless station at the Bush terminal, and also there is the Telefunken station in addition to the Sea Gate station and the New York Herald station, and these stations all handle traffic without delay, and in no case is nondelivery due to interference. The only case of that kind has been at the navy yard station at Brooklyn.

Gov. Griggs this morning touched on the importance of the Marconi coast stations in the general business of communication between ship and shore. I have first-hand information on that subject because it is part of my duty to maintain the apparatus at ship and shore stations so that they will operate effectively. I say without hesitation that if the coastal stations in the United States are turned over to the Navy Department the service rendered from ship to shore will be highly inefficient, and there is no doubt about that statement. I have listened to the operations of the Navy wireless stations; I have heard them work with ships at sea and with other stations, and at the same time I have heard the commercial operators working with ships at sea and shore stations. The comparison is about from 25 to 75 per cent in favor of the commercial station, and any good telegraph man who has handled the traffic will bear me out in that statement. The coastal stations also, as the governor has said, provide the spare parts and the operators and a thousand and one details that I can not go into here. These are very vital to the shipowner, because the ships run to various ports and they depend on just that particular service in order to make their communication possible.

Now, we must not confuse what radio communication is. Apparatus alone is not radio communication. It consists of apparatus, operators, system, and an organization. Each one of those elements is vital to the success of the whole system, and when you take the coast station business away from the commercial companies you cripple not only the ship and shore business, but also the interior business to the serious detriment of the shipowners and the commercial companies.

I notice also in the minutes of the testimony of the supporters of the bill that they claim there is confusion in time of distress. Now, the only confusion I have found so far, gentlemen, is in the record giving the views along these lines of the supporters of this proposed bill.

When a vessel calls "S. O. S." the signal indicates distress, all commercial radio work must cease, and immediate attention given the vessel calling S. O. S., and this is invariably done. The existing law gives the power of controlling ship communication to the nearest coastal station.

There have been a number of cases where ships in distress have sent out these calls. I can cite the case of the *Republic* at Siasconset. There was no confusion of messages at that time. Messages were sent for help and they resulted in the saving of life and everything was properly done. The same applies to the case of the *Titanic*. Even at the station at Sea Gate, which is located in the heart of the so-called interference area—I have on record seven cases of distress where the Sea Gate station handled a great volume of business without any difficulty. Now, where is the confusion in time of distress? There is no confusion whatever.

The training of the operator has been touched upon. That is a very important question, because that is the human element of wireless communication and as such should receive earnest consideration. The operator who goes into the wireless business to-day does not go into it as the operator did in the early days, when it was a romantic proposition. To-day the operator goes into the wireless business with the serious view of earning a livelihood. If he is confined to a ship station where the salary must be in conformity to the general salaries paid men on ships, then his sphere of usefulness is limited. But if he is given the opportunity of going to a coastal station after he becomes proficient, then to a high-power station, and in an organization like the Marconi company he has the opportunity to go through the various departments of the company—commercial, traffic, engineering, and so on—then there is something in store for him and we can enlist the services of good operators. But if we confine him on ships he at once loses the opportunity and we lessen the standard of the operator. As a result of that the efficiency of the service must be impaired.

There is another point I want to mention in connection with interference, and it is this: When interference does occur the majority of it must occur from ships, because there are more ship stations than there are coast stations. The proposed bill does not touch upon that question at all. It does not correct the condition in regard to the 600-meter wave length nor the 300-meter wave length, which is insufficient. If the Navy does take over the coastal stations, it will still have to handle the same volume of traffic that is handled by the commercial companies. The time limit will not be cut down, but it will be increased because of inefficient operation on the part of Navy operators. Therefore, how will it aid in solving the problem of interference?

In conclusion, I want to emphasize a point in regard to neutrality, about which my predecessor, Mr. De Sousa, has spoken, that is as to the question of censorship and the possible violation of neutrality. I want to say that in spite of the various rigid regulations that have been put on my company by the Navy Department, during the entire period since the beginning of European hostilities there have only been two cases in which the Navy Department has complained, and these have been presented to you by Mr. De Sousa, showing that in both cases the complaints were unjust.

Now, Prof. Goldsmith, director of the Institute of Radio Engineers, intended to appear before you, but unfortunately he was taken ill at the last moment, and so he requested me to read and file with the committee the following communication:

JANUARY 17, 1917.

TO THE COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,

House of Representatives, Washington, D. C.

GENTLEMEN: The undersigned desires to place himself on record before your committee as strongly opposing the proposed act to regulate radio communication, drawn up by an interdepartmental committee under the leadership of the Navy Department. He believes this proposed act to be the most serious menace yet faced by the radio field, both as to proper service to the public and as to continuous future developments and research in this field. Some of its provisions he is forced to regard as actually vicious in their disingenuousness. Some of his detailed objections follow:

First. The act is quite unnecessary at the present time. Such slight defects as have existed in previous legislation on this subject have, on the whole, not

markedly retarded progress, and it is impossible not to recognize the generally excellent and benevolent attitude of the previous acts. As an expert in the radio field the undersigned is unable to see any reason why the present laws should be changed in the directions indicated in the proposed act.

The CHAIRMAN. I note that he very cordially approves the present law.

Mr. GRIGGS. He does, and we have not found any fault with it.

The CHAIRMAN. I know. I am just calling the attention of Mr. Kintner to that fact.

Mr. SARNOFF. The point Mr. Kintner had in mind this morning was in regard to the 600-meter provision, which can be very easily corrected. Dr. Goldsmith's letter continues:

Second. The act under the guise of regulating the radio field actually aims to strangle and then eliminate all commercial operating companies. This is evidenced by the sections of the act wherein the widest powers are given to the Department of Commerce, through its Secretary, to declare that stations must be closed because they interfere with Government communication, by the new, stringent, and amazingly unnecessary restrictions in wave lengths on land stations and the provisions permitting the purchase of stations from probably ruined companies within the next five years. It is quite evident that the framers of the proposed act hardly expect the operating companies to survive the next few years of unfair competition combined with unreasonable regulations.

Third. The reasons advanced for the passage of the act are trivial and not valid. For example, it has been stated that naval operators do not secure sufficient practice in peace times. Furthermore, it is claimed that the only way of training operators in sending and receiving through interference the strays is by the drastic step of Government control and ownership. Nothing could be further from the truth, as any teacher in a school of radio operating could readily show. It is quite possible to make artificial signals, interfering signals, and artificial atmospheric disturbances in every respect equivalent to those experienced in practice and to enable the operator to secure any desired degree of skill with actual receiving apparatus and actual transmitting apparatus with artificial antennæ or aerals. To ruin new and growing field to give Government operators practice is surely an astounding "counsel of despair," particularly when it is seen that there are at hand means whereby the practice may be secured without tumbling the entire present structure of the radio field to the ground.

It is further claimed that the matter of interference between radio stations can be solved only by the proposed act. It is true that some interference exists at the present time between stations just as there is occasional friction between enterprises of any sort. The proposed remedy is the absurd one of absolute tyranny by the elimination of the enterprises themselves.

As a matter of fact, the problem of interference is sure to be solved in the near future by technical means now under development by the companies. There need be mentioned only such expedients as sustained wave radiation, beat reception, and certain other methods not as yet published. In view of these, the proposed act is untimely and useless as a means of eliminating interference, which should not be legislated out of existence by the extinction of healthy development, but avoided by sound engineering expedience. The success of this latter method of procedure is unanswerably demonstrated by the remarkable development of the wire telephone field along engineering lines. It is quite evident that the proposed act is in this regard to the last degree reactionary and unimaginative.

Fourth. It has been claimed the proposed act constitutes a step toward national military preparedness, but if it is so intended it will certainly fail in its aim. The present war has demonstrated clearly one thing, and that is that the industrial foundation and engineering skill of a country are the most important factors from a military standpoint. This might not seem to be the case with military men of an older school, but it is now evident that unless a great number of manufacturers and their cooperating engineers are given full scope for developing a strong peace-time structure, in times of stress the country can not adequately respond. But Government ownership and competition in a field like the radio field where returns are at best very limited would effectively strangle

all private enterprise and cause this country to drop rapidly back into an inferior position in this art.

The Government has never shown any tendency toward constructive improvement in commercial lines and has rightly left these to individual initiative. This policy has been amply justified in other communication lines. It is now proposed, suddenly, to alter entirely the formerly successful policy and to take over a partially developed field just when those who have devoted their lives to its development are beginning to reap the fruits of their labor. The futility and injustice of such an attitude are equally marked.

It can be safely asserted that not 1 per cent of the improvements in the field of radio communication have originated with any Government department. The advances have all been due the commercial companies and their research engineers.

As a result of many years experience and thought in the radio field, and after having been in close touch with the Government departments and the companies for a long time, the undersigned can state unreservedly that he is sure that the proposed policy of the act in question would be to the last degree destructive of progress in the radio art, thus jeopardizing an important communication system, the safety of life at sea, and our national safety. He earnestly urges the abandonment of so disastrous a policy.

Very respectfully,

ALFRED H. GOLDSMITH, Ph. D.,

Editor and Director of the Institute of Radio Engineers, Professor in Physics at the College of the City of New York, Director of the Radio Telegraphic and Telephonic Laboratory of the College.

Mr. GRIGGS. I understand there are two amateurs here. They do not represent our company at all. I think they would like to be heard this evening. They are not connected with our company, but I am only saying this as "amicus committee."

The CHAIRMAN. We will hear them and then adjourn until tomorrow..

STATEMENT OF MR. CHARLES H. STEWART, OF ST. DAVIDS, PA., REPRESENTING THE WIRELESS ASSOCIATION OF PENNSYLVANIA.

Mr. STEWART. I am here representing the Wireless Association of Pennsylvania, and also by special request the radio associations of Germantown, the South Jersey Radio Association, of Collingwood, and the Atlantic City association. There are a number of members belonging to these various associations who are interested in this bill because for a number of years past they have been operating stations in an amateur way. A great many of them have since graduated from the amateur ranks, some into the ranks of the Marconi Co. and some in other lines of similar endeavor. Our association is somewhat at sea regarding this proposed legislation, in view of the fact that Commander Todd stated in the early part of the hearings that in no way was the status of the amateur affected by this bill. If we could agree with him in that particular, of course, we would be satisfied. However, there are certain paragraphs in this bill which we believe will change the status of the amateur, or at least are susceptible of changing the status of the amateur. We would be at the mercy of the Department of Commerce in the administration of the law. I refer particularly to section 14b, which provides for the closing of stations for periods of five months and successive periods of five months, without limit, entirely upon the discretion of the President in time of peace. Now, the members of our association have no objection whatever, because they are all

patriotic citizens I am sure, to closing their stations in time of threatened war or public disaster or any other similar situation. But the unlimited nature of this paragraph is such that any station in our judgment could be closed for successive periods of five years and no redress is provided in the bill. The question of compensation for the taking over of our stations is one that we had not considered necessary to think about, because in time of war there is no question, I feel sure, that practically all of our members would be a unit in coming forward and helping the Government in every way possible. And remember, gentlemen, that there will be a number of field activities in war time in which we will be needed, for instance, in aeroplane work and Army work and activities of that kind. Remember, also, that the commercial operator is a good Army buzzer and he can jump right into those positions in time of emergency, where there is an absolute need of efficient men in the Signal Corps forces. There are sufficient men in our organization to take care of any army of any size.

Then in section 17 there is a point which has not been touched on as yet, I do not think, to any extent by anyone. However, it is a matter which should not be passed over without some mention. In the present act, the act of 1912, one section provides that the logarithmic decrement for transmission shall not exceed two-tenths, which is a very technical expression. There is no need to go into a technical discussion of the details because that would require a long explanation. At the present time we have this two-tenths limit, and we might be allowed to continue under this two-tenths limit. A year from now the Department of Commerce or some other department might impose a limit of one-tenth. I do not say that it might not be reasonable to do that, but at the same time, with no limit named in the bill, five one-hundredths might be named as the logarithmic decrement, and it looks to us as though it was leading up to nothing but undamped waves being used; in other words, leading to where sparks could not be used. The amateurs of the country have been doing good work in the past two years, and under the act of 1912 have been going along very satisfactorily. The complaints of the amateurs have been few. I do not know of any personally. Of course, there is hardly any case of an amateur who did not make some complaint. At the present time they are operating over somewhat greater distances as compared with what they operated over two or three years ago. There are some stations that are operating between New York and Chicago on many nights. Personally, I have operated with Wheeling, W. Va., from Philadelphia almost every night for five months, using only three-fourths of the power that I am allowed to use under the act of 1912. I think Mr. Armstrong can bear me out that there are certain amateurs communicating between New York and Chicago with some regularity, are there not, using your regenerator set?

Mr. ARMSTRONG. Yes.

Mr. STEWART. And under some sort of license?

Mr. ARMSTRONG. Well, I never attempted to make any money out of the amateur field.

Mr. STEWART. But as a matter of fact, as a matter of training for the defense of the country you are willing to do that?

Mr. ARMSTRONG. I do not care to make any money out of the amateur field.

Mr. GRIGGS. Can you give us an idea as to how many amateurs there are in your class?

Mr. STEWART. There are 6,000 amateur licensed transmitting stations, and we do not have any idea of how many receiving stations there are.

Mr. GRIGGS. Because they do not have to have any license?

Mr. STEWART. Yes; because they do not have to have any license, and quite properly so. We fought for that proposition in 1912, and we succeeded in having the word "receiving" stricken from the bill.

Mr. GRIGGS. As I understand it, these 6,000 licensed senders are in line for service in case of emergency?

Mr. STEWART. Not only in radio service, but in Army service. They would be very valuable in case of any future needs of the Government. If you do anything to discourage their efforts it will react; even though the radio should be turned over to the Government, it would react on the Government in the failure to develop the talent to operate these stations.

Mr. HADLEY. You think it would have that effect?

Mr. STEWART. Yes; I think it would have some effect of that kind.

Mr. HADLEY. Why?

Mr. STEWART. I think that a great deal more interest is aroused, a great deal more enthusiasm, than could be aroused by the effort of the Government to enlist men for that purpose. I believe that the natural enthusiasm of the amateur is absolutely necessary for the development of the service. I think some of the managers of the Marconi Co. know that to be a fact. Now, as I understand, there was a letter read before the committee by Mr. Maxim, of Hartford Conn. Mr. Maxim is well known, and I believe he approves this bill, but he does not in any way represent the amateurs of our district. I confess I can not understand his attitude in favoring the bill, because of the possibilities. He may have some reason for favoring the bill which is not apparent to me. That is all I have to say.

Mr. EDMONDS. Some of the apparatus used by amateurs is very cheap in price, is it not?

Mr. STEWART. Yes, sir.

Mr. EDMONDS. What could you buy a cheap apparatus for?

Mr. STEWART. Well, you can buy it at most any price. A great many of the young men start by making their own apparatus, and then as they advance they purchase apparatus, and sometimes they make their own sets of a very elaborate nature.

Mr. EDMONDS. Is there anything in this bill that would tend to discourage them from doing that work?

Mr. STEWART. It would entirely depend on the application of the bill. If the bill puts the commercial companies out of business, that one fact alone would have a big effect in discouraging the amateurs. Certainly, with the commercial companies out of the way, we feel that the next step might be to get the amateurs out of the way. In other words, we are fearful of what might follow.

Mr. EDMONDS. This bill places such discretionary power in the hands of the Department of Commerce that they could almost limit you in any way they pleased?

Mr. STEWART. Yes.

Mr. EDMONDS. And it would prevent the young men from turning their efforts in the direction of improving the wireless?

Mr. STEWART. Yes, sir; and in improving themselves, because wireless starts the train of thought among the young men and is a good influence among them generally. I am not speaking of my own case, because I am getting to such an age that I can afford to drop a good deal of it, except that I take an interest in it in the evenings sometimes. But there are plenty of young men who are coming along to whom I think it would be a great benefit. For that reason we believe that the law of 1912 is adequate. There has been some little interference, of course, but that has been largely overcome. The fact that a man in New York can work with a man in Chicago shows that the interference must have been overcome.

Mr. EDMONDS. Have any of your amateurs ever been complained of for interfering with the stations of the Government?

Mr. STEWART. I can not answer that question definitely. I imagine that sometimes, once in a while, one of the operators might have been complained of, but nothing of any consequence.

Mr. EDMONDS. That is a great deal the fault of the operator, is it not?

Mr. STEWART. Yes, sir; that is largely the fault of the operator.

Mr. EDMONDS. An operator can put his apparatus in touch with another apparatus without causing any interference?

Mr. STEWART. Entirely so.

Mr. EDMONDS. And without getting outside persons into any trouble?

Mr. STEWART. Exactly. The fact that amateurs all over the country are communicating with one another nightly leads me to believe that they have solved the problem of interference to a very large extent, because they have a very much larger field to work. Now, whereas the Navy has the whole field in the matter of wave lengths, the commercial company has the field from 600 meters down to 300 meters, which gives them a fairly good field as compared with the amateur who is limited to 200 meters and below. When you get below 200 meters the chances of communication at any great range is not very good. The improvement has been more than we expected it would be four years ago. There has been improvement because of the fact that they had to work down at those low wave lengths.

Mr. EDMONDS. Your suggestion is that it would be better to leave the old act alone?

Mr. STEWART. Yes. It has proven very satisfactory, and the Department of Commerce has treated every one fairly, and has treated the amateurs the same as they have treated the commercial companies. I can not see why the Government should be put to the large expense of reissuing all these licenses. That is another point that has not been touched upon. This bill would require the reissuing of 10,000 operators' licenses and at least 6,000 transmitting licenses.

Mr. EDMONDS. Do they make a charge for that?

Mr. STEWART. No; but it would certainly cost the Government something for all that work. The only charge that would be entailed

on the stations would be for the making of an affidavit, swearing to the application. It would necessitate the printing of regulations by the Government and a good deal of correspondence.

The CHAIRMAN. Mr. Stewart, were you at the hearing before the committee in 1912?

Mr. STEWART. I was not before this committee. I was before the Committee on Commerce in the Senate on that bill. I did not get notification at the time of the hearing before this committee.

The CHAIRMAN. You amateurs were very much alarmed then, were you not? You were afraid that if there was any legislation you would be put out of business.

Mr. STEWART. No. There were certain features that we were alarmed at. One feature was in regard to receiving, and we had incorporated in the bill before it was passed certain language which cured that feature.

The CHAIRMAN. This committee cooperated with the Senate committee and spent many months on the other bill, and we are glad to know it has not hurt anybody.

Mr. STEWART. Mr. Chambers also represents our association, and he would like to be heard for a few minutes.

(The letter from Mr. Stewart appears on pp. 229-231.)

STATEMENT OF MR. FRANK B. CHAMBERS, REPRESENTING THE WIRELESS ASSOCIATION OF PENNSYLVANIA.

Mr. CHAMBERS. I also represent the association that Mr. Stewart represents—the Wireless Association of Pennsylvania—including the wireless associations of Atlantic City, South Jersey, and Germantown. I do not know whether we have any need to be very much alarmed over these regulations, but we sort of felt that if the commercial companies were put out of the field in any way the amateurs would lose interest. If it had not been for the commercial companies in the first place, I doubt very much whether any amateur would have been interested at all. I do not think there would have been very many amateurs. The amateur will only exist as long as there is something to be accomplished. The same was true of wire telegraphy when it was first invented. A great many men put up wires from one house to another to see if they could talk to each other and see who could do it best. As soon as the commercial wire telegraph companies arrived at some satisfactory condition the amateur end of it fell off, and they went to work for these companies. But, gentlemen, I do not think the wireless is going to fall off so quickly. I suppose I will be old and gray before it does, but you will have to look after these fellows as we go along. There have been some remarks made here that I overheard and they surprise me. I have been interested in playing with wireless sparks for about 12 years. I guess I am familiar with a great deal of the wireless apparatus that is being used to-day.

There has been some complaint made about the amateur operators interfering with Government stations. If the amateur had as much interference as I have heard referred to here, I think we ought to drop out of business. It is nothing for me to sit and hear a couple of little boys—they call them kids—chirping with a couple of little kilowatts a great distance away. I can even hear the League Island

calling out "Q R T," which means shut up, and "Q R T X," which means to get out of that. The little kids have only a narrow field in which to work. I have heard the kids talking about their apparatus, that they had caught the navy yard apparatus, and when I called up the navy yard to tell them about it they would say that they did not hear it. Now, if that little kid with a 6-kilowatt transformer gets in touch with the navy yard, believe me, I would like to see the navy yard talk. I can go into Philadelphia and pick you out some little boys, between 14 and 18, who are not operators at all; at least, they do not know they are operators; they do not know they are as good as you are, but they are really operators; not would-be operators, but real operators. They are working with cheap apparatus. Most of them make their own apparatus. A lot of them find old junk around the house and put it together to make their sets with. I know some of them have made the sliders on their tuning coil out of a tomato can and their sliding rods out of strips from stairways. If some of you could see some of that apparatus you would have to ask what it was all for. It does not look like electrical apparatus. It looks as though in house cleaning time the mother had found a lot of stuff around the house and concluded that it was nothing and threw it aside and it landed on the table and the boys had got some wiring and made an apparatus out of it. Those little fellows can sit down there and do work that surprises the men.

Now, if the commercial companies were to be put out of business I do not think the amateur would have so much interest as he has now. Really, gentlemen, I would hate to see anybody put out of business. In my opinion, I should think that there ought to be some legislation enacted that would notify all the citizens who are interested in wireless to see how bad they can interfere with the Navy and Army and say, "Now, fellows, we will offer you a certain bonus if you can stop the Navy from working altogether," and give those fellows some kind of practice, because in time of war if they are going to be interfered with in time of peace by little kids with 2-kilowatt apparatus, if those two kilowatt stations can interfere in such a bad way as they say they do, suppose we have war? What are you going to do then? How about when the navies of foreign countries come over here to our shores? Are they coming over here with one-quarter kilowatts or 2 kilowatts? No. They are going to come over here with great big battleships with 6-kilowatt and 10-kilowatt apparatus, such as the British ships have been using right here in our waters. And suppose they come to our land stations, what is going to happen to our apparatus? Well, you will have to look into the history of the United States to see if we have got a wireless station in the United States. Why, gentlemen, it is ridiculous. I would be ashamed if I were these men and got up and said things like that. I do not know where the fault lies. It is either with the apparatus or the operators. I know a fellow who was working with the Marconi Co. and he got fired. I said, "What did you get fired for?" He said, "I could not get the stuff." Now, a fellow who reports to the Marconi Co. that he could not get his message because the Navy or an amateur or a couple of kids interfered with his work, and he says, "Well, I did not do much this week. Too much interference." He is fired. That is the end of that fellow. I do not believe they would let him

live a week on the job. I think the present managers, etc., have got a little better system than that. I think they will let him last until about noontime.

Now, I think the Navy Department is misinformed about some of those interferences. This is all news to me, that all this interference has been going on. I will tell you what I would do. I think they ought to mix up these operators a little and find out who are the good ones and find out what they can do, and keep on changing them until they get some good ones. I know there are a lot of good operators around, but I do not know whether they want to enlist or not. Gentlemen, I would feel sorry for this country in case of war, because if you could just listen to some of these British battleships with their batteries running up and down the scale, why, it sounds just like music, and we could not tune them out; why, we would just have to use the fellow on horseback like they did away back long before the day of wireless telegraphy—yes; a man on horseback, swimming.

Now, I did not come down here to get mixed up in all this, but I am a real bug. I kind of like this, after all. I did not know all this interference was going on; no, I did not. I will have to go home and make something new. I once thought I was an inventor, but I did not know; oh, no; I was not. I thought I had invented something and I was telling a man all about it. Yes; I invented something, and he asked me all about it, and I explained it to him. His name was Wesley Miller. He went down to the navy yard in Philadelphia and he told Capt. Moses all about what I did. Of course, I got a little bit enthused over what I thought was an invention. I probably said a lot that I ought not to have said, and he went down there and told Capt. Moses all that I had said. Capt. Moses called me up on the telephone and asked me if I had done this, and I said to myself, "Oh, what have I done? Oh, here goes my license and all my apparatus and everything." Then he went to work and told me what I had said to Wesley Miller. I said, "Oh, yes; I did say that." He said, "Would you prove it?" I said, "Yes." He said, "Well, we will send a man up there to see you. What night will suit you?" I said, "Any night at all. After supper I have not got anything to do but gab in the air." So he sent a man up to see me—a Mr. Forbes, I have got his name down here. He said he was his chief electrician. He called at my residence, 2046 Arch Street, that evening. It was some time in June; I have not got the date, but I have got the name and everything. I showed him what I could do and Mr. Forbes congratulated me. He shook hands with me and patted me on the back, and he said, "I am going to make an official report. You are going to hear from this." I was tickled to death. I went home and went to bed, but, gentlemen, I could not sleep. I said to myself, "Here I am, an inventor, and the Navy is going to use my invention." Well, I got all fussed up over the thing, and in the morning I went down and looked in the mail box. Nothing doing. That went on for quite a while and I began to think "Maybe this fellow got killed on the way back to the navy yard. Something has happened, surely." That was in June. Now, some commercial interests got hold of this and they wrote me letters and I answered their letters and I gave them the whole story and all about it. They wrote me very cheerful letters, and they said they had made some

exceptional distance records with the assistance of my idea. That kind of encouraged me a little, and I said, "Oh, gee; that fellow Forbes must have made a bum report about me. I have not heard from him yet." If you call that encouragement—well, "some" encouragement.

Of course, I do not suppose I will ever be a real inventor, but I would hate to see the little amateur put out of business. I heard about this letter that was written by Mr. Maxim. He says that he is thoroughly satisfied. I don't know how he can be satisfied, because he is an amateur. He told me that he would be in favor of some kind of legislation to regulate the fellows who had a little bit more money to spend on better apparatus and eliminate the kids who had \$5 and \$10 apparatus. Now, all of us started with these \$5 and \$10 apparatus, and I do not agree with Mr. Maxim. I think if they would just leave the law as it is, nobody would kick. If the navy yards or the Navy Department wants any assistance from us amateurs they can come around and we will demonstrate. Now, we are satisfied with the present bill. The present bill—

The CHAIRMAN (interposing). You mean the present law, do you not? You do not mean this bill?

Mr. CHAMBERS. Oh, no; I mean the present law. We do not want this bill at all. I will tell you, gentlemen, we were kind of wondering who the fellows were who worded that bill there. I might have voted for one of those fellows, but if I did, I am sorry for it.

Mr. EDMONDS. I think I can enlighten you upon that. Every bureau, except the Pension Bureau, was in it.

Mr. CHAMBERS. I think some day, if this country ever has a war, the Navy Department will be very glad that this interference is going on. I think you ought to encourage it, because the more quickly you develop it, the more necessity you will have to do away with it. You know, necessity is the mother of invention. If we do not have any interference, nobody will invent anything to do away with it. I think you ought to make it a good, broad, open question and say, "Now, here, you fellows, Navy, amateur, commercial fellows, go to it." In a case of that kind the fellow who is the best operator and has the best apparatus is the one who is going to "clean up." In time of war you can pick out those men and say, "Fellows, we need you. There is the enemy. Pick them out and clean them up." And they will do it. The way it is now, a lot of fellows sit in their chairs, afraid to move their arms for fear they will be paralyzed if they make the slightest move, so they do not move a "slider." Why, they think they are operators. I have seen some fellows, who are real operators, whose sliders are out. I think if you look into it in a real straightforward manner you will see that that is nonsense, all this talk about amateurs, because what we need is developers. Do not stop the thing now. It will be an awful time to stop it. You have got us all worked up over some of the possibilities of the wireless. I think it would be a terrible thing to stop it now. I think if the Navy Department would go around and clean up some of the fellows who do this hollering, you would not have to do all of this legislation. I think the officers at the head of the Navy Department have been misinformed by the operators at the various yards. I think that probably, if you look into it deep enough, you will find that the operator is not efficient in

this way: Here is a message going along and it is going too fast. He says, "Can't get that. Interference with kids." And that is what goes down on the log sheet. Here is another good habit. Even when you make a mistake you do not like to own up to it. Sometimes the fellow will misspell a word and they will say, "Kids are interfering." They want you to think that the key has stopped when they actually misspell a word. If the Navy operator can not get it he will say "interference" just to clear himself. I do not know whether that is the case, but I think that the officers should look into it. If they do, I think they would find out that a lot of this interference, that they have heard about does not exist at all. So I would recommend that they stir the operators up and pick out the good ones, and let the others go down to the border, or something like that, and carry water for the soldiers.

I am surprised, as I said two or three times before, that there is so much interference. I did not know there was so much until I came here. I never heard of it, and I am on the job every evening when I have not got anything else to do. I sit there listening until I get blue in the face. I do not hear any interference. Once in a while I hear some kicking. But we have got so that we tune out these stations and we do not hear most of these kicks, I guess. But just to leave the old law the way it is, I think we will get along very well, and after a while when the art is so big and prosperous, so that we do not need any development, then make another bill and say, "Now, you fellows, stop right where you are. We do not need you any more."

Of course, that is the amateur way of looking at it. I do not belong to the Marconi company. I have no money to invest in such things. They talk about this amateur business. Let them go along and make all the money they can. If the navy-yard fellow will only get busy and get a little buzzer and practice up on this interference proposition, we ought to be able to get back at these Marconi fellows. That is what I say. Let them practice up awhile and next session you will see the Marconi fellows coming here and wanting to have this bill passed. That is all I have got to say. Thank you.

Mr. STEWART. I would like to have my letter inserted in the record, the letter I addressed to the chairman of the committee.

The CHAIRMAN. It will go in.

(The letter referred to is as follows:)

ST. DAVIDS, PA., January 5, 1917.

HON. J. W. ALEXANDER.

*Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives, Washington, D. C.*

DEAR SIR: Your letter of December 29, 1916, just received upon my return from a short absence from home, hence the delay in making response to your courteous invitation to submit to you in writing any criticisms of the proposed radio bill as regards the provisions affecting amateurs. At the outset it is proper for me to say that I represent the amateurs of the city of Philadelphia and contiguous territory in the eastern part of Pennsylvania, and have their hearty support.

I shall endeavor to be as brief as possible, and, if necessary, will amplify what I now have to say at the hearings to be held by your committee.

Upon an examination of the bill, it would seem that with but two or three exceptions the situation of the amateur under the bill will remain largely as it is at present. At least that seems to have been in the minds of those responsible for the drafting of the bill. Were it not for these two or three exceptions,

the bill could not have been objected to by the large body of amateurs. These, however, are of such nature and importance that we are unwillingly dragged into a matter which we had hoped had been satisfactorily settled for some time to come when the radio legislation was passed in 1912.

The first exception which we take to the bill is to section 14, and especially to paragraph B thereof. It seems to us to be an unheard of proposition that the President, or any other authority, shall be given the power to close duly licensed radio stations, conducted in a lawful manner under their license, for successive unlimited periods of five months each, in time of peace, without being called upon to state any reason for the issuance of such order to close. There is a very broad amplification of the power given in the act of 1912, at present in force, wherein, in section 2, it states that "every such license shall provide that the President of the United States in time of war or public peril or disaster, may cause the closing of any station and the removal therefrom of all radio apparatus, etc." The amateurs are entirely satisfied to abide by the provisions as stated in the present act, and, as patriotic citizens, stand ready to assist their Government in cases of necessity. In fact, many of them have placed their names on file at the request of the naval radio service, making themselves and their stations available in time of need. This means something, because under the present more advanced state of the art as regards amateur stations, many of them are now successfully communicating over distances of from 500 to 1,000 miles, even with the limitations under which they are compelled to work, and included in their ranks are many of the best operators of the country so far as efficiency is concerned.

We believe it is un-American to impose upon us a condition such as is proposed in the section above referred to, and we make a strong protest against the enactment of any such provision, as with such a clause in force any one of us could be ordered to close our station without the assignment of any reason, and without any manner of appeal being provided for. We do, therefore, most earnestly suggest that the following verblage be substituted for section 14-B as set forth in the bill, to wit:

"The President, further, in time of threatened or actual war in which the United States may be a party, and in time of public peril or disaster, may cause the temporary closing of any radio station within the jurisdiction of the United States and the temporary removal therefrom of any radio apparatus for a period or periods of not more than five months each, or may authorize the temporary use of the station or the apparatus thereof by any department of the Government for a like period or periods upon just compensation to the owners."

Secondly, it is objected to that no specific or stated value for the logarithmic decrement is assigned, and that, under the vague generality of the provision as framed, power rests with the Department of Commerce to impose not only one but several different values and that such values or limits may be set at the mere discretion of that department as would be unattainable practically for commercial or experimental purposes, and the successful operation of any station might thereby be rendered impossible. In the face of the fact that proper limits practically attainable are well known in present government and in present commercial service, no legitimate purpose is to be gained by the failure to assign such specific limits in the act of Congress itself. If the present limit, which provides that the logarithmic decrement shall not exceed two-tenths, fails to meet the exigencies of the situation it is not the fault inherently of the value of that limit, but rather the fault of the department in charge of the administration of the law in failing to be able to compel strict observance of the present provision of the law. We therefore urge upon you the justice of having the required logarithmic decrement specifically stated, and that it shall be fixed at the same value as in the present act, namely, two-tenths.

Thirdly, we again contend, as was most vigorously fought for in connection with the previous legislation, that receiving apparatus and the variants of radio apparatus, which pertain to receiving alone, should not be made subject to the jurisdiction created by any act to regulate radio communication. It is an utter impossibility to prevent the reception of signals if it is desired to accomplish this by surreptitious means, and the aim of a broad provision of any act to deprive anyone of lawful opportunity to receive signals if desired, imposes restrictions only on well-known and readily accessible stations of

great prominence and on patriotic citizens, leaving still ample opportunity for undesirable aliens or others to accomplish their purpose without detection.

By reference to our arguments, when the present act was under consideration, you will see that it was our contention that Congress had not the power to impose licenses for receiving stations; that the same by the very nature of things were beyond Federal jurisdiction; and that any attempt to incorporate such a limitation would constitute a violation of these rights, and of the constitutional rights of their citizens, which proposal we believe was acquiesced in at the time by the members of the Senate Committee on Commerce and other Government officials with whom the matter was discussed, with the result that the bill was accordingly amended prior to its passage.

In accordance with the definitions in section 1 of the bill, we believe it entirely proper to urge that a section should be added to the bill specifically accepting the operation of the proposed act from jurisdiction over stations equipped with receiving apparatus only, as we will have a draft for submission at the proper time.

The point which stands out most prominently to us is—why change the present law? It has seemed to work out most satisfactorily. If the law is changed it will involve a great amount of additional labor, the expense of formulating and printing new regulations, as well as the reissue of some 6,000 station licenses and 10,000 operator licenses, which would be necessary under the bill as at present drawn.

We trust that our statement of the matter may receive the thoughtful consideration of yourself and your committee, and we thank you for the opportunity given us to submit our views.

Very respectfully, yours,

CHARLES H. STEWART,
*For the Wireless Association of Pennsylvania,
Chairman Legislative Committee.*

(Thereupon, at 5.20 o'clock p. m., the committee adjourned until to-morrow morning at 10 o'clock.)

RADIO COMMUNICATION.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 19, 1917.

The committee met at 10 o'clock a. m. Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. Prof. Kennelly, of Harvard University, is here and if there is no objection we will proceed with him

STATEMENT OF PROF. ARTHUR EDWIN KENNELLY, OF HARVARD UNIVERSITY.

The CHAIRMAN. I presume you have read the bill which is under consideration?

Prof. KENNELLY. Yes, sir.

The CHAIRMAN. Will you kindly give the committee your present position and—

Prof. KENNELLY. And qualifications to speak on this matter?

The CHAIRMAN. Yes.

Prof. KENNELLY. I was born in Bombay, East India, a subject of Great Britain, and was educated in France, Italy, and England. I was a telegraph operator at the age of 15. I left school at the age of 14, to become an operator in cable telegraphy, and I earned my living as an operator until I was about 19 years of age, when I became promoted to electrician on a cable ship. At 21 I was in charge of operations in laying and repairing submarine cables, which was my work for some seven years, during which time I was engaged in the laying and repairing of submarine cables all over the world between Great Britain and India. I also have had charge of the laying of cables in this country, along the Mexican coast for the Mexican Government.

In 1886 I came over to this country and became Mr. Thomas A. Edison's principal electrical assistant at his laboratory in Orange, N. J., and I served for him and his companies about seven years. I then left his employment to go into the business of consulting engineer with Prof. Edwin J. Houston, of the Thomson-Houston Co., in Philadelphia. In 1902 I was appointed professor of electrical engineering at Harvard University and am now professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology.

It has been part of my work at these institutions to teach the principles of radio telegraphy; not as an operator, never having trained as a radio-telegraph operator, although I have a small set in my

house and am accustomed to listen in to messages and eavesdrop generally in that way.

I am the retiring president of the American Institute of Radio Engineers; have been past president for two years of the American Institute of Electrical Engineers and also past president of the Illuminating Engineering Society; and I am a member of many scientific bodies. As retiring president of the Institute of Radio Engineers, I am very much interested in this bill. I am not interested commercially in any way; I do not own any stock, and I hold no commercial interest in any radio telegraphic concern; but I am profoundly interested in this as a past president of the Radio Engineers, as a member of the teaching profession, and as an American citizen. For all those reasons I am deeply and earnestly concerned in this bill and the question of its passage.

I am here to urge my contentions that this bill should not be passed for a variety of reasons. In the first place, if there is one thing of which this country ought to be proud it is that this country has taken such a shining position in the world in regard to telephonic communication. I do not mean radio telephonic communication, because that is a very young art, although it is coming along; but I mean telephonic communication generally. It was this country that first established communication with France by telephone and with Honolulu by telephone, and there is no other country in the world that has any such telephonic record. And that has been accomplished because the telephonic art in America has been fostered and developed under free institutions and not under Government control. In those countries of the world where there is Government control of the telephone and telegraph you will find them in a relatively backward state. I went to France a few years ago in company with an American gentleman. We stopped at a hotel in Paris. He was very anxious to talk with somebody on the telephone. I tried to dissuade him from doing so. I said, "Do not waste your time trying to talk over the telephone, because the telephones are very unsatisfactory here." He said, "But I must telephone." He had been accustomed to using the telephone constantly in his office in New York. I said, "Well, if you insist, come with me"; and we went to the telephone bureau, so called—a very miserable little concern, like a shoe-blackening box, in charge of a man who did not know much about it. He had a great deal of trouble in getting the central station at all. Finally, when he did get the central station, he abused them in unmeasured language, which would not have been tolerated in this country. The whole system is in a very backward state—largely because of Government ownership.

The CHAIRMAN. Right at that point, if you will pardon me: Is the telephone system in London controlled by the Government?

Prof. KENNELLY. Yes, sir; at the present time it is. It was not a few years ago, but it is now, and it has become in a worse condition since the Government has taken control than it was before it was Government owned. Everybody admits the telephonic communication in London is defective, and was better under free administration than it has been since it was taken over by the Government; although when it was under free administration it was so hampered by the Government that it could not properly develop. That is common knowledge.

The CHAIRMAN. I know the service is very poor, from personal experience.

Prof. KENNELLY. It is, sir. I take pleasure in indorsing your statement.

While I was president of the Institute of Radio Engineers, the question of this bill came up before the board, and at a meeting of the board, which I attended, certain resolutions were adopted. I want to say there was entire unanimity among the members of the board on the passage of these resolutions. They felt very earnestly and very forcibly upon this question, because they were representatives in this country of the science and art of radio communication; not because they were interested in any particular commercial enterprise. They may, of course, have had some commercial affiliations in the back of their minds, but in considering this question they stood for the engineering development of this young and thriving art, and felt their responsibility, as members of the Institute of Radio Engineers, in developing and perfecting it.

May I read these resolutions?

The CHAIRMAN. Yes.

Prof. KENNELLY (reading):

Whereas certain unwise provisions in the London Radio Telegraphic Convention of 1912 through serious governmental interference have retarded the engineering development of the radio art; and

Whereas the development of new arts of electric communication has always been checked by Government interference and has always been fostered by the existence of free individual initiative, as, for example, telephony in the United States; and

Whereas many important problems in radio telegraphy and telephony are still unsolved, as, for example, the problems of long-range radiotelephony, adequate selective reliability, call systems, and the elimination of atmospheric strays; and

Whereas the solution of these important problems calls for the highest engineering and inventive talent and research; and

Whereas such inventive effort and research can only exist under free institutions, and under the stimulus of healthy competition; and

Whereas certain foreign Governments have assisted and not opposed individual initiative and private enterprise in developing the radio-communication systems of their countries with great success; and

Whereas Government competition, or confiscation by the Government, would effectively stifle inventive effort; and

Whereas the military control of radio, or any public-service communication in times of peace, virtually constitutes a continuous military inquisition into private correspondence, an undemocratic and dangerous institution; and

Whereas the reliability and superiority of our radio communication in times of sudden national peril is dependent upon the inventive and engineering resources of the Nation, which should therefore be kept at the highest pitch and of the broadest scope: Therefore be it

Resolved, That the board of direction of the Institute of Radio Engineers is opposed to the competition by any department of the Government, and particularly by any military or naval department, with existing organizations founded for radio communication; and

Resolved further, That this resolution be brought to the notice of such congressional committees as may have charge of any proposed legislation on the subject.

The radio engineers of the country by a large majority would probably indorse those resolutions, although we have had no actual test vote.

The CHAIRMAN. How many members are there of that body which adopted those resolutions?

Prof. KENNELLY. This was the board of directors, sir. It is the board of directors that signed and passed those resolutions. I believe they were read at the following general meeting, and I understand they were generally indorsed. I was not present. There has been no formal canvas; there has not, in fact, been time to have a formal canvas of the whole membership of something like a thousand members upon that point.

The Institute of Radio Engineers is deeply concerned in this because they have charge, naturally, of the engineering future of the art. This was, originally, purely a scientific art a few years ago. It has now become an engineering art, an applied science, in which money is expended in a definite way, under the control of engineers, for producing the best effects in the service of the public. As you know, there are certain corporate interests in this country that serve the public by investing their money in stations for the transmission of news whereby we, all of us, including all in this room, are benefited. And this bill, if passed, will undoubtedly have the effect of stifling and arresting that work and that development. It will inevitably have the effect of crippling those stations and putting them out of business. Now, I have no commercial interest in this; but there are, to my knowledge, many people, good citizens like ourselves, who have invested their savings in these stations and in this work, partly, no doubt, because they hope to get some financial return, but also partly because they think they are being patriotic to this country by supporting a young and promising art; and they think by taking part and sharing in that stock they are helping along the whole interests of the world, and particularly of America, in this wonderful art. This bill should not allow one man, a Government officer, to lay his hands upon all that property and suppress it, and then, after having suppressed the property and making it become of no value, thus enable it to be purchased by some department of the Government at scrap prices. I am not here to asperse anyone; certainly I have no rancor against the Navy or against any department of the Government; I simply have opposition to this bill. And I refuse to believe that any Government officer, or any naval officer, drew that bill for the purpose of confiscating this property in so mean and contemptible a manner. I refuse to believe it. I have many friends among the naval officers, and as a profession I have the highest admiration for them, and I refuse to believe any officer of the United States Navy drew that bill with the intention of doing such a mean and contemptible thing. Nevertheless, it will have that effect, and if passed in the form in which it lies before you it will be an everlasting disgrace to the Government of this country and to the people of this land.

One of the alleged reasons—

The CHAIRMAN. Right at that point, I wish you would indicate the provisions of the bill which you think would have that effect. I have in mind, I think, the ones to which you refer.

Prof. KENNELLY. Certainly, sir. Section 6 states that after three months and within five years after the expiration of said three months, the Government, through the Navy Department, shall have authority to acquire, by purchase, at a reasonable valuation, any coastal radio station now in operation in the United States which

the owner may desire to sell. There is nothing there to determine what is a reasonable valuation. After you have so far invalidated and destroyed your neighbor's property, he may be willing to sell at famine prices. And, of course, you have all heard the truism "I do not care who makes the laws so long as I have the construing of them." And with the permission for the Government to enter into competition with the coastal commercial radio stations, and with the power given them to regulate their opponents, it needs very little imagination to see what the effect of such competition and regulation would be upon their neighbors.

The CHAIRMAN. So that in your view the power there to purchase and the power to regulate would accomplish that result—that is, they could do it?

Prof. KENNELLY. It certainly would have that effect.

The CHAIRMAN. I understand your position now.

Mr. ROWE. And your idea is that after reducing the earning value by putting another station alongside of it, or by competing with them, then they are in a position to buy.

Prof. KENNELLY. Without even doing that, simply by taking the naval stations they have now, and then regulating the commercial stations, that could be accomplished.

Mr. ROWE. By using them for commerce?

Prof. KENNELLY. Yes; by using them for commerce, and then by regulating the other fellows who are in competition with them for that commerce. Of course, I believe they are all above any intention of doing that, but they will say, you must have this apparatus; you must improve this; that won't do; you must change this; and, by constantly harassing them and changing this, that, and the other thing, and regulating them, they would eventually put their competitors out of business. They have that power; and the temptation to do so would be very great. I do not say that any officer of the Government has that in mind at this time; I won't asperse any officer of the Government to that extent. But I say this bill gives that power, and it would be a strong temptation, with that power, for any zealous man. If he feels zealous on behalf of his own department, he would undoubtedly transcend the limits of fairness and fair dealing in the exercise of his discretion. And we can not blame him. This bill gives most oppressive and dictatorial powers. This kind of a bill is what we might expect the German governor, Von Bissing, to promulgate for Belgium; this is what we might expect a military officer to lay before a conquered country and say, "Do this or I will confiscate your property." This is not the kind of a bill that we would expect from a free Government, which stands for liberty before the world, to lay before the people, its public servants, in time of peace, for their control. In time of war—that is another thing.

Mr. EDMONDS. You do not mean only sections 5 and 6, but the regulatory provisions all through the bill?

Prof. KENNELLY. Yes. I only quoted section 6, but I allude to the bill as a whole.

Mr. EDMONDS. You allude to the regulatory provisions running all through the bill which change the present existing law.

Prof. KENNELLY. Yes, sir. I speak also against this bill, sir, on behalf of the Navy itself; or what I consider to be the best interests of the Navy itself. I hold that it is very important that in the next

war this Navy of ours shall be supported and shall be strengthened to the utmost by all of our collective ability. I stand for that; I am heartily in favor of anything that will support our Navy in time of war. But I do not think in order to support our Navy in time of peace we should massacre a necessary and honest public servant. I think in order that the Navy shall be properly strengthened in time of war we must develop the radiotelegraphic art to the highest pitch. And if you give a monopoly of the radiotelegraphic art, under the possibilities of this bill, to any department of the Navy, you are giving it to somebody whose main interest is in something else. The Navy is a fine profession, but the Navy is not a radioengineering profession. You might as well offer a monopoly of the radio art to the professions of divinity or of law or medicine. It is not an aspersion on the medical profession, not an aspersion on the legal profession, to say that they are unfitted for the control and the monopoly of radiotelegraphy, as an art. The proposition only needs to be stated to be condemned; and yet the Navy is no more entitled to it.

Mr. Chairman, I have the honor to say I consider it is of the very greatest importance for the sake of the Navy itself that this art should be maintained at its very highest pitch and that America should be foremost and not hindmost in the international competition for the utilization of the ether and the surrounding atmosphere of the globe. Hitherto it has been a saying among all the people of the world "The air is free." This bill wants to make that saying a dead letter. If this bill passes, within three years the air will no longer be free for the use of anyone.

The Navy says, "We are bothered by interference." How much better is it for them to be bothered by interference in time of peace than to be bothered by interference in time of war. They say, "Let us have no interference now; let us be comfortable and happy; and let us communicate with each other and with our brother officers on each other's ships." But when foreign cruisers come over here, will they listen to those proposals? What happened off South America when the English commander, Admiral Craddock, was defeated in that fight? His wireless was jammed by his opponents. If he had had a superior wireless system, he would have been free from all radio hindrance and interference from his enemies. It was one of the circumstances that led to his defeat, that his wireless system was subject to interference. Now, what we must have, for the sake of ourselves and the Navy, for the sake of all of us, is a system which will be free from interference. And are you going to produce a system which will be free from interference by saying in time of peace that there shall be no attempt at interference? It is easy to have no interference when a monopoly exists. But the thing to seek is plenty of interference; so much that you will be forced to use your wits, to use your inventive genius to overcome it. And already great steps are being taken in that direction, and already the outlook in this direction is very hopeful for the future. Why, it is nothing by comparison with what the telephone has done in this country. It was in this country, in America, that all these important improvements have come about in the telephone, as a direct result of interference. I can remember, and I dare say my friends here remember, what it was in the early days of the telephone. You could not talk to your

neighbor without hearing all the neighborhood. And that was a growing trouble. It was the haunting problem day and night of the telephone engineers—"What shall we do to get rid of this eternal eavesdropping of the world?" It has been now so thoroughly eliminated you could hardly realize from using the telephone today that there ever had been such a period. Why? Inventors came forward, all the brightest minds in the telephonic art were stimulated to do something to overcome this difficulty. But now if you are going to introduce a plan to suppress this interference because it has been causing a little trouble and been preventing some one (Government officer from hearing another Government officer, of course, you will have a fool's paradise for the time being. But what of the hereafter; what of the radiotelegraphic art and the countless generations to come? We want the whole world to be benefited by this art; we want each neighbor to communicate with the other, and we want to have all of that progress in store for us hereafter. And therefore I say do not pass this bill, gentlemen.

We want the Navy to be strengthened. It can not be strengthened in this way. It can be pampered and weakened, but it can not be strengthened. The right way to do is to have the Institute of Radio Engineers and a lot of bright lads all over the country working on these problems and coming forward and offering various means for preventing interference, and saying "I have now a scheme." If it will serve, reward him by giving him encouragement. But if you attempt to do away with interference under the proposed régime, you would stifle that enthusiasm absolutely. Those men will not have any such enthusiasm if it is in control of some department of the Government, because they can not hope to reap any benefit by finding a solution of these problems. They will say, "Why, the Government takes, by confiscation, any invention it wants to appropriate; the Government takes my invention and gives me nothing." They do that now. And what hope is there for reward or of benefiting our fellow creatures by having a solution of this problem?

But if you leave them alone you can have this Army of amateurs all over this country listening in with their little wireless stations and hearing the pulse beats of the world, as it were. All those young men are thinking, and some of them will discover something which will be of benefit. If you take this bill and use it as it will probably be used you will throw a pall of apathy and discontent and hopelessness over the whole situation. You will darken America and darken the atmosphere of the whole globe. Don't pass this bill!

I want to speak also on behalf of the amateurs. It is not only the vested interests of people who have put their savings into this enterprise for the benefit of the public; it is not only for the Navy, but it is on behalf generally of the amateurs of the country, for the young fellow who wants to communicate with his neighbors and utilize the atmosphere of the world—the circumambient ether, as it is called. It is him that I am thinking of; you will suppress him, too. So soon as you have scrapped and suppressed the power stations, the commercial stations, you will still be bothered in the antiquated system in undisputed control of the Navy that no longer has interference from power stations—it will still be bothered by this

man here and this little amateur here, and some officer will say he can not get rid of that interference or that he is being bothered by so and so, when "John Smith is talking in Washington we can not hear ourselves talking in New York." And so they will appeal again to Congress to stop the amateur, and there will be no use of the circumambient ether except such as the Navy Department or some department of the Government wants.

Mr. EDMONDS. They would not have to appeal to Congress, because the bill gives them the power not to give any license.

Prof. KENNELLY. All right, sir. I am not a lawyer, so you will correct me. The whole system will be one of repression and star-chamber action and confiscation. There will be a dead silence in the air. It will be a silent globe.

If you will go to some central radio station with a big tower anywhere in this country and listen in, you can hear hundreds of people talking to each other, most of them without any interference at all—only occasional interference. It is so when we are talking to each other in a room, using the same air. We have interference, don't we? One man has to be silent when another one wants to talk. We have to have etiquette; we can not all talk at once. That is interference. For example, the same interference would result in the atmosphere in this council chamber; if you all talked at once, you could not hear me. And if you go to one of those stations and listen in, you will hear hundreds, perhaps even thousands, talking by radio, depending on how delicate the apparatus is and how far it can hear. If it was delicate enough and powerful enough, you could hear all the radio people in America talking; and they are all learning and all gaining some advantage. It only takes one-twentieth of a second from the time you close a key here for its impulse to get to Europe.

You will be putting all of that world of communication in time of peace in the hands of the Navy, to restrict for their own purposes and suppress that interest of the amateur and make a desolate world of it. I do not want to see that state of affairs in America, the land of freedom. The amateur needs to be protected just as the Navy needs to be protected and as the commercial stations need to be protected. We all need to be protected. We have no quarrel, one against the other. We all have difficulties, but they are difficulties which sensible men can overcome. The only difficulties that can not be surmounted are imaginary ones; the real difficulties are capable of being overcome. Here is a difficulty, the difficulty of interference, the difficulty that all messages can not at present always be carried at the same time. Very well; let us be sensible. Come, let us take counsel; let us have representatives of the various parties in interest meet around a table, and when they shall have met around the same table we will find some intelligent means of overcoming this trouble. But don't give us a star-chamber means by which the Navy can issue the fiat that there shall be no trouble.

In time of war the Navy wants the very best; it wants the very highest support, the most cordial support, of every one of us. Are we going to give that support by saying "Take the whole radio arc, and then slumber over it, because you are too busy with your own affairs to consider this and develop it. This is a mere detail to you; you have thousands of interests to take up your energy, and if you

are going to fritter your time away upon this profession, you are no sailors; your profession demands you." Take Capt. Bullard. I had the honor of meeting him. Look at him. He was in charge of this naval radio service up to a little while ago. Where is he now? I understand that the Navy Department has called him away, and he has forgotten all about this by now. And by the time he is through serving on his ship, in his line of duty, he will find himself behind in the art. Are you going to put this art in the hands of officers who will be taken from one post to another and have all of their efforts thrown to the winds? You want the highest intelligence, the highest specializing in this work. It takes the best brains we have. We can not be content with one-quarter of the brain of a man in another profession. We want the best the country can produce, and you will have that by leaving the country alone, by having national competition among the radio engineering profession fostered by the aid given it from commercial enterprises and the amateur. After they have developed it in time of peace, then should war come upon us, the Navy could come forward and say, "Now, because the country is in danger, we want the whole thing." And when that times comes, we will say, "Everything we can do is at your command." We will all doubtless support the Navy in that, and willingly. It is for the Navy's own sake, therefore, that I say keep the Navy's hands off at the present time, in order that it can get a fuller control when the need comes.

This country has had war, on the average, every 30 years, since it has been a country. It can not be supposed we will never have another war, and we must look forward to having war again because a national habit of this sort can hardly be lost in a few generations. When it comes we want to see America ready, gentlemen; we want to see the radio art supreme, and not to have it smothered by the restrictive monopoly of such a law. Should we have war, I want to see the naval officer helped; I want to see the Navy helped, not hindered, but assisted, and the best way to help is to keep hands off in time of peace and then give them the whole thing when it needs it, and when it will probably need it in a hurry.

Now, let us have all the regulation you want. Let us have regulation to put the whole thing in the control of the President in time of need, so that the whole system can be taken over by the Navy for the protection of the country. In that I say amen. But in time of peace do not suppress everything in sight merely because a few men can not get messages through with certain apparatus. That would be a crime, a great injustice. And the more you reflect upon it—

The CHAIRMAN. What would be the effect, say, should the Marconi Company monopolize the wireless? I mean any commercial company, not that company particularly, but any other commercial company?

Prof. KENNELLY. Any commercial company? Any commercial company whatever that is a faithful servant of the public and doing its duty to the public and to the United States under the existing laws of the United States is subject to the call of all of its apparatus, operators, and equipment in time of need, is competent to carry out its work. There is far less danger of a single company's monopoly than of a Government monopoly.

The CHAIRMAN. That is the point I want to make: Would not there be some danger from a monopoly of the suppression of the development of the art?

Prof. KENNELLY. No; not anything like to the same degree. I would like to see several companies at work; I would not like to see all under one company, not even the manufacturing of apparatus all in the hands of one company. But even with one company in undisputed occupation of the field, there would still be an opening for every one to develop the apparatus which would find a purchaser in the open market. There would still be opportunities for everybody, under this Government and under the Constitution of the United States, to carry on reasonable radio communication in the use of the free atmosphere of this world. But to put all of that in the hands of the Government, to give the Government the power to suppress everything, then there will be no hope for any of us; we are all lost.

The CHAIRMAN. Of course, you are assuming that the Government would pursue that very stupid policy.

Prof. KENNELLY. If I were an officer of the Government, sir, in charge of stations which are competing for commercial service, to make a showing of returns on my books for the money I took in and turned in as cash receipts to the Treasury, I would do all I could to increase the amount of commercial service which I rendered. I would be doing my duty in enhancing that to the very utmost limit without injuring my conscience. And my conscience would probably be deadened if I were an earnest and zealous man, and I should probably trespass upon the rights of my neighbor and say, "Look here; your rates are not suitable to me; your apparatus is not satisfactory to me; your wave lengths are not satisfactory to me; your decrement is not satisfactory to me. I want you to change this and that, and I want you to do so and so." And I would hinder him and put all sorts of obstructions in his path. And in a little while, by following that policy, and by reducing my rates, I should own the whole thing.

Mr. GREENE. Are you familiar with the existing law of 1912?

Prof. KENNELLY. I have read it; yes.

Mr. GREENE. Is that satisfactory?

Prof. KENNELLY. I believe that is working satisfactorily, sir.

Mr. GREENE. And you can accomplish all you think ought to be accomplished without any further regulation?

Prof. KENNELLY. Without any further regulation at all for a good while. It has been the fact in the past and is now the fact that the only people complaining, apparently, are the people who have all the power now, who can take all the possible wave lengths from a meter to a hundred kilometers. The only people who can not do the same thing are the commercial interests. The Government can use everything. The people who are complaining are the people who are not restricted; and the people who are not complaining are the people who are restricted. Is that fair? All we ask here is fair play, fair dealing, and fair play to the people who have their money in it; fair play to the Government; fair play to the departments; fair play to the amateur—fair play all around. Give us all a fair deal. And I say this bill, manifestly, is unfair.

Mr. EDMONDS. In your association you have, you say, about a thousand radio engineers?

Prof. KENNELLY. Yes, sir.

Mr. EDMONDS. And they are continually investigating and hunting up new methods in this art?

Prof. KENNELLY. More or less; I do not say all of them, but many of them are.

Mr. EDMONDS. Many of them are, and they are specialists in their line?

Prof. KENNELLY. Yes, sir.

Mr. EDMONDS. And what you want to bring out particularly, I presume, is that those men who are at present specialists are working ahead on the line which they will probably continue for the balance of their lives?

Prof. KENNELLY. Yes, sir.

Mr. EDMONDS. But if this gets into the hands of the Navy, and it should turn out as you state it probably will, those men would, of course, go into other professions?

Prof. KENNELLY. They would have no reasonable expectation of remuneration or livelihood by staying in their present profession.

Mr. EDMONDS. And then the business would eventually go into the hands of men who were located for three years in the business, and then have to go into some other line of business?

Prof. KENNELLY. Those Navy men are fine men, mind you, and nothing I am saying here is intended to reflect on them. But they are busy with their own affairs and busy with their profession, and busy with thousands of other things. A Navy officer's life is full of businesses and activities. And how can you expect a man with so many calls upon him to spend his time in developing the needs of this young and growing art. If he does, he is neglecting his duty.

Mr. ROWE. Has England, Germany, or France gone on and developed, independently, aerial stations for the navy?

Prof. KENNELLY. I understand, sir, that all the Governments in Europe have Government apparatus and equipment. But some of them have permitted, and even fostered, individual ownership and individual development. For example, Germany has by its Government, instead of confiscating inventions or seeking to confiscate stations, helped private enterprise with her capital and with her brains and with her administration in order that when the Government wants to secure universal control, in case of war, they may be better off. That is the reverse of the policy that this bill suggests.

Mr. ROWE. There has been a good deal of testimony here during the last two or three days about the interference in the ether of these waves. Has the art itself kept on with the increase of business?

Prof. KENNELLY. Yes, sir.

Mr. ROWE. Is it just as easy or easier now to receive a message as it was five years ago?

Prof. KENNELLY. Easier, without interference. The people in the commercial interests do not seek any legislative restrictions. They are getting along all right. They have no interferences to speak of. They have a little. But the only people who are complaining are the Navy Department, who naturally tend to get behind all the time. You can not blame them. If we were in the Navy, we would do the same thing. We would have other business to attend to, and we would naturally tend to drop behind in these matters which are only

little side issues to them. And it is vital to the whole world and vital to the Navy itself that it shall be kept up to the highest pitch by having as many of the brightest men as possible take it up and develop it; not just a few naval officers, here and there with a few hours to spare, taking it up and thinking about it.

Mr. SAUNDERS. You are a radio engineer, I understand.

Prof. KENNELLY. Yes, sir. Not by profession, but I am a radio engineer in the sense that I have taught radio engineering and have been acquainted with the art since its inception.

Mr. SAUNDERS. Now, with respect to this art becoming a monopoly in the natural commercial development, is not there less reason for this becoming a monopoly in that way than either the telephone or the telegraph, by reason of the fact that this means of communication here is common to all the world without any expenditure, all the expense involved being in connection with the erection of transmitting and receiving stations?

Prof. KENNELLY. That is right, sir. And if you leave it all alone and do not hamper it, this is far less likely to become a monopoly than any other existing means of communication.

Mr. SAUNDERS. Of course, the ether, which is the vehicle of communication here, is free to all?

Prof. KENNELLY. Yes; and we hope it will be freer yet.

Mr. SAUNDERS. Now, on the subject of interference that has been discussed before the committee to some extent and about which we read a great deal, that is entirely, if I may so style it, due to this jostling of waves in the ether? That is what interference is, is it not?

Prof. KENNELLY. The waves do not interfere any more than sound waves do. It is the intelligence behind it that gets jostled, and we have not found complete means as yet of overcoming that difficulty.

Mr. SAUNDERS. But still the waves do get jostled in respect to receiving?

Prof. KENNELLY. No, sir.

Mr. SAUNDERS. The communication does, just as the atmosphere does here if we would have 40 people talking at once in this room?

Prof. KENNELLY. The waves do not bother each other. It is the same as when we are conversing and the ears are doing the receiving. It is the mind behind the ear that gets bothered.

Mr. SAUNDERS. That is what I said, in respect of receiving; a multiplicity of waves at the same time, because of the defect at the receiving end of it, do bother and interfere with the reception end?

Prof. KENNELLY. If you do not take precautions, they do.

Mr. SAUNDERS. And in respect to taking those precautions, that is just a matter of development of the receiver?

Prof. KENNELLY. Yes, sir; of a suitable transmitter and receiver.

Mr. SAUNDERS. Well, the transmitter, that only relates to furnishing wave lengths of a different length?

Prof. KENNELLY. Yes; but there are transmitters and transmitters. But, broadly speaking, I agree with you.

Mr. SAUNDERS. The transmitters are only for the purpose of furnishing waves of different lengths?

Prof. KENNELLY. And shape, too.

Mr. SAUNDERS. I suppose you might say length and size.

Prof. KENNELLY. Length and size and individual shape—contour.

Mr. SAUNDERS. For instance, you take a transmitter, say one at New York and one farther down the coast and another one a little farther down the coast, and conceivably they all might be sending out waves of the same length and contour—shape—does that make any more difficulty with respect to receiving than if those waves were of different lengths and shapes?

Prof. KENNELLY. Broadly, it does; and it would have produced far more trouble a few years ago, because there was far more difficulty in listening to 1 man out of 50 talking at once a few years ago than there is now.

Mr. SAUNDERS. I understand development has been made along that line.

Prof. KENNELLY. And the development is going on.

Mr. SAUNDERS. I was just trying to get down to the fundamentals of what this thing means—interference.

Prof. KENNELLY. Yes.

Mr. SAUNDERS. I understand the art has developed along those lines?

Prof. KENNELLY. That is right, sir.

Mr. SAUNDERS. Then one method of reducing this trouble is for different transmitting stations each to have a wave length of their own, different from the other transmitting stations? That, to some extent, will overcome this question of interference?

Prof. KENNELLY. Yes, sir; to some extent. And I fully believe 10 years hence we will have many methods. We are only at the beginning of this art, which is only a few years old, and in 10 years the radio engineers and radio specialists and scientists will invent things that will make our present conditions look like the extinct dodo.

Mr. SAUNDERS. We hear more in this inquiry about the difficulties they have at sea on the vessels there and, of course, we all agree it is very essential, so far as possible, that the communication with vessels at sea should be as uninterrupted and as definitely received as possible. Now, do I understand that that difficulty with respect to these vessels grows out of the character of the apparatus that they are using? Are they behind in the art in respect to the apparatus they are using?

Prof. KENNELLY. Partly so, sir; partly on account of the nature of the conditions. Ships naturally will be the last to benefit by improvements which are made on shore; because they must be standardized and more or less must all have the same kind of apparatus. You can not be changing them all the time. But the improvements that are made on shore will gradually drift into the ships, so that they also will become in time the beneficiaries and sharers in non-interfering systems. The improvement is first made in the shore stations, and then it drifts into various ship stations and to the amateurs.

Mr. SAUNDERS. Then, it is the question of working out the installation of the apparatus?

Prof. KENNELLY. That is right, sir.

Mr. SAUNDERS. Because on the other hand there would be too much scrapping at once.

Prof. KENNELLY. That is, if they all talked in the same key, and all said the same words, and all talked together, there would be no

hope of distinguishing them. But if we begin by having people talk in different tones of voice, one man in a bass voice and one in a high treble, then you could pick out the bass voice and pick out the treble voice. And after you get an apparatus whereby you can send out sounds in a different pitch, then you are in a position to get another apparatus which will only hear the bass voice, and so on. The possibilities of the art are enormous. The possibilities are wonderful, if you do not suppress them.

Mr. SAUNDERS. The proposition of correcting this interference by suppression of development, then, is not one that appeals to you?

Prof. KENNELLY. It is the worst way to advance, by suppressing the difficulties that have to be overcome.

Mr. SAUNDERS. If we could imagine such a thing as the Government absolutely controlling all this thing and having reference to the relief of interference at sea, there would be two ways, then, of getting at it: One is to stop transmission except from certain stations—stations that they might absolutely control; and the other way, which would be the better way, would be to install on these ships as fast as they are developed the latest things in the way of improved receivers.

Prof. KENNELLY. With reasonable fairness to everybody, to be accomplished by consultation.

Mr. SAUNDERS. And under the system of natural development that is just exactly in the commercial world what you would want to get, is it not?

Prof. KENNELLY. Exactly what we would want to get.

Mr. SAUNDERS. To get in touch with the very latest thing in the commercial field?

Prof. KENNELLY. Naturally the commercial man wants to do that. That is the incentive he seeks, to do that as far as he can unhampered.

Mr. SAUNDERS. In the commercial world in these great shops is not the tendency of every up-to-date shop to install as rapidly as can be that which represents the very latest in his particular piece of machinery and particular piece of work?

Prof. KENNELLY. The scrap heaps outside of the shops are very large.

Mr. SAUNDERS. One more question in connection with the opportunities for the inventor: In the inventing world does the inventor find that the largest opportunity for him in the way of return on an invention is found in undertaking to dispose of his inventions to the Government or being able to offer them freely to the competing commercial world?

Prof. KENNELLY. Experience has shown him in the last few years that he has no hope with the Government. The Government will help itself, and his only hope lies in getting remuneration from a fair-minded commercial world.

Mr. SAUNDERS. Then, so far as incentive to the men working along this line, the very greatest incentive is offered if you leave it commercially free?

Prof. KENNELLY. Absolutely the only incentive.

Mr. SAUNDERS. And where incentive is found is where is found the best work. I imagine that to be a commonplace, but I imagine it is about true.

Prof. KENNELLY. I suppose it is almost self-evident, sir.

**STATEMENT OF WALTER H. PUMPHREY, ESQ., REPRESENTING
THE FEDERAL TELEGRAPH CO. OF CALIFORNIA.**

Mr. PUMPHREY. The Federal Telegraph Co. is a corporation of California and has written a letter here which is addressed to Commander Todd through error. It should have been addressed to the committee. However, I wish to read the letter and make a few comments from time to time, and then file the letter as a part of the record. They first refer to section 2, paragraphs 1 and 3, on the matter of the classification of stations. This is not important as to the proposed amendment relative to Government ownership. If, however, the bill, in its present form, goes through, then the classification may become important, because it is a question whether this company's stations are coastal or commercial. Now, they say, relative to paragraphs 1 and 3, section 2:

These paragraphs define coastal and commercial stations, respectively, the former classification specifying stations used for the exchange of correspondence with ships at sea, and the latter land stations, used in the transportation of commercial business and not used for the exchange of correspondence with ships at sea.

The Federal Telegraph Co. is operating seven stations which handle not only commercial point-to-point business, but also business with a certain number of vessels which are designated in the licenses.

As over 95 per cent of the business handled by these stations, however, is point-to-point commercial business, it is presumed that the stations referred to would be classified as commercial stations.

As I say, if the bill, in its present form, goes through, that question may become important as to whether they are coastal stations or commercial stations.

The letter next refers to section 5 of the bill, saying:

This section allows the opening of all Government radio stations to general public business, and leaves the fixing of rates for such service to the heads of the departments having jurisdiction over stations, subject to control of such rates by Congress.

We have heard this section very ably discussed and at considerable length, so it will not be necessary for me to dwell on it. However, the company takes the position that it would be most unjust on account of possible Government competition, as has been pointed out here by many of the other witnesses. They say:

Under this broad provision it would be possible for the Government to cut the rates and engage in competition with commercial radio companies that have large investments involved and that have spent years in building up a commercial business.

Now, as we have just heard stated, paralleling commercial lines by the Government, plus control by the Government of such commercial lines, would make possible competition that would be ruinous to the commercial interests. That has been explained to you gentlemen at such length as to make further remark from me unnecessary. My company cites an instance of this. They say:

As one instance which would affect the Federal Telegraph Co. very seriously. It is obvious that if the Navy Department should desire to accept commercial business between its new station at San Diego and Pearl Harbor, it could completely destroy the present traffic of the Federal Telegraph Co. between the United States and Honolulu, and render the very considerable investment of the Federal Telegraph Co. in these stations as of no value.

So they enter a mild protest as to that section, for the reasons there stated. They next take up section 9, paragraph 1. And I may say here that the Federal Co. has had very little opportunity to study the bill. A copy of the bill was received at a very late date, so that their study was on a draft of the bill as presented before the interdepartmental committee at the public hearing given. And they are not entirely familiar with, or have not fully appreciated, all that this present bill means; so they have unfortunately hurriedly discussed the paragraphs that seemed to affect them most. Now, in reference to section 9, paragraph 1, that has also, I am very fortunate in being able to say, been fully set forth before the committee from the standpoint of the outside interests. On the question of the power in the President to take over these stations in time of peace, my company says:

This provides that the President of the United States may cause the closing of any commercial station, or may authorize the use of a station by any department of the Government, upon just compensation to the owners, as provided in a subsequent section 14 (b).

It is recognized that a drastic act of this kind would probably be necessary and advisable in the event of war, but it does not appear just that the Government should have specific authority to take over private property in such a manner in time of peace and in the absence of any public emergency.

Then going on to the question of compensation, they say:

A question of just compensation in such an instance is one that will be most difficult and, in fact, one practically impossible to determine.

Now, we heard yesterday considerable discussion on this point, and again I am relieved of commenting and will continue:

* * * In the event of seizure by the Government of any one or all of the stations of the Federal Telegraph Co., which would be possible under this provision, the measure of damages could not be based on the loss of revenue during the existence of such seizure, and an appraisal of the damages sustained by the company on account of the disruption of its business would inevitably be a matter of the utmost difficulty to determine justly.

Commercial radio companies must face the contingency of their property being taken over in the event of war or of some great public emergency, but should not be subject to such proceeding in time of peace.

And we very strongly indorse the views of the opposition as to the disadvantage of power being lodged in any one official of the Government to do this thing in time of peace.

They next refer to section 24. I do not know that that has been touched on by anyone here on the point of division of time. They say:

The provisions of this section, limiting the operations of commercial stations to every alternate hour in the event of their interference with Government stations, might make possible the elimination of all commercial stations doing point-to-point work.

The Government stations are not limited in any way under this act as to the use of wave lengths, and if a sufficient number of wave lengths should be arbitrarily adopted by a Government station in the vicinity of a commercial station it would be possible for the Government station to claim the existence of so much interference from the commercial station that the latter could be forced to observe the division of time specified in this section.

No commercial radio station doing a point-to-point business in competition with cable or land telegraph lines, such as the Federal Telegraph Co. is doing, could remain in business if it could operate only during every alternate hour.

While it is not suggested that this provision would ever intentionally be enforced unjustly or arbitrarily, and while we take pleasure in having this opportunity of stating that the Federal Telegraph Co. has always received

most courteous consideration from the Navy Department whenever there have been any questions of interference between Navy stations and the company's stations, we must state our very serious objection to such a provision in this bill which might be capable of being construed in such a way as to completely put our company out of business.

Respectfully,

H. P. VEEDER,
Vice President and General Manager.

I do not know that I can say any more, in view of what has already been said. The company is very much in the same position, to a limited extent, at least, as the Marconi Co. If the Government ownership proposition goes through, this company is out of business, so far as operation is concerned. It has most satisfactory and cordial relation with the Government at the present time in supplying apparatus, my company being the owners of controlling patents of the so-called Poulsen arc system, which I believe is to-day a decided advance over the so-called spark system, and which arc system is being rapidly adopted by the Government to replace the spark system. So that, on the manufacturing end, the company's situation is most satisfactory, and it is with considerable regret that we have come in to oppose. But, as a matter of principle, we file this protest, setting forth the main points of the bill which seem to affect the company most seriously.

**STATEMENT OF MR. JOHN L. HOGAN, JR., CHIEF RESEARCH
ENGINEER NATIONAL ELECTRIC SIGNALING CO. OF PITTS-
BURGH, PA.**

Mr. HOGAN. I am chief research engineer of the National Electric Signaling Co., of Pittsburgh, for which company Mr. Kintner spoke a short time ago. I am also vice president of the Institute of Radio Engineers, which Dr. Pupin and Dr. Kennelly have represented before you, and am chairman of the standards committee of that body.

My connection with radio telegraphy has extended from 1902, when I began as an amateur, through a professional connection with De Forest in the development of the audion in 1906; studies in electrical engineering at the Sheffield Scientific School of Yale University; and from 1910 up to the present time in professional connection with the National Electric Signaling Co., first as telegraph superintendent; then as chief of operating, erection, and inspection; and then as chief research engineer, which position I now hold.

The general matter concerned in the pending bill has been treated with in great detail, of course, by other speakers. There are some points however which have not yet been emphasized; and I trust that what I may be able to say on these points may prove of some interest and assistance.

On the matter of neutrality, I can say very little. Gov. Griggs and Mr. Kintner have covered the international aspects, and Mr. Kintner has also discussed its true effects, and, I may say, the absurdity of some types of neutrality regulation affecting radio without having a similar effect upon other means of communication. The present operation of neutrality regulations, such as those proposed in the bill, has been discussed by Mr. De Sousa and by Mr. Sarnoff and it has been shown that such provisions as prohibit alien ownership, alien control, and alien operation would not secure the desired end.

Capt. Bullard, in his testimony of January 15, at pages 103 and 104, pointed out that foreign-owned corporations could easily and did form American companies which answered all the legal requirements on the matter of neutrality, and yet they were subject to control from outside of this country. It is evident that this bill does not provide any adequate or effective assurance of neutrality, and that the Government ownership and responsibility proposed would raise vastly more serious international problems than would result from private ownership. The testimony before this committee has shown that the Government has been by far the most flagrant violator of the present neutrality regulations.

In the matter of preparedness it has been well brought out by Dr. Pupin, Dr. Kennelly, and Mr. Chambers that the proposed bill can not work toward true preparedness. I can not go so far as to say that there should be intentional interference created for the purpose of practicing tuning, but certainly we should not provide a "bed of roses" for the Government operators to lie in. They should be forced, at least, to bring the standard of their operations up to that of the commercial companies. The commercial companies are not suffering from severe interference, as has been testified, and as I will bring out later in one or two detailed cases to be quoted.

The Government is suffering from interference, according to the various reports of its operators. It has been well shown that this results generally from the mishandling of the apparatus. It has been testified that the Government apparatus is of the finest type. It has also been shown that interference exists, and, by Mr. Clark in his testimony of January 17, at page 8, that the Government finds it necessary to make the apparatus which it secures from the commercial companies more nearly foolproof, in order to secure any results from it. Mr. Clark's testimony on this point is a glowing commentary upon the personnel in charge of Government apparatus in numerous instances. The present bill, which attempts to stop the annoyance occasioned by the mishandling of good apparatus, is only an attempt to make the whole art foolproof rather than to overcome the difficulty intelligently. Dr. Goldsmith's letter and various other comments have shown that true preparedness must come through the utmost development of the technical and intellectual side of the art rather than by elimination of the difficulty itself. As Dr. Kennelly pointed out this morning, in the matter of interference it must be noted that the commercial companies are substantially free from difficulty. It has been testified here that the Wanamaker station prevented the operation of shore stations in communicating with ships in its vicinity. In answer to that Mr. Sarnoff testified that the Marconi station at Sea Gate had no difficulty in carrying on ship communication while the Wanamaker station was in operation. Mr. Armstrong testified he had no difficulty in receiving communications from Arlington at New York, while the Wanamaker station was in operation. I testify that our station in Brooklyn, some 2 miles from the naval station and 3 or 4 from the Wanamaker station, has no difficulty in its ship operations when the Wanamaker station is in operation. That is really because the apparatus of the same character is handled properly. Such interference as does exist now in the radio field is on the ship wave

length of 600 meters, which is fixed by the London convention. There are occasionally interferences caused by improper adjustments of apparatus—or caused by lack of cooperation. But they are insignificant; they have been minimized and are being further minimized by operating under regular traffic arrangements.

The greatest point which has been made in the matter of interference relates to the difficulty in securing distress messages from ships. I have followed the operation of radio telegraphy for a number of years now, and although I have personally listened to a number of distress calls, S O S messages or C Q D messages, as they are called, I have never yet heard of a single case where interference caused dangerous delay. I doubt if testimony can be brought forward to show a single instance in which interference has caused loss of life at sea. On this matter of interference, although there has been much testimony in the abstract, I have noted that the only definite, concrete statements have been those made by the opponents of the bill. It seems a curious thing, if so much interference actually exists, that the radio inspectors of the Department of Commerce should not have been brought here to tell you about it. These men are located in the important ports of the United States and are familiar with the traffic conditions and the steps which have been taken to overcome such difficulties as are enforced by the 600-meter requirement of the London convention. I believe that they will all testify that such interference as does exist is that which is forced upon radio stations by the present wave-length regulations—the London convention—and that in spite of this detrimental and dangerous restriction, the interference is far less to-day than it was a year ago or five years ago.

The matter of interference itself, and what it is, has been explained in great detail. There are some further points on that which I might bring out, but I would rather answer specific questions should any of you care to ask them of me. It is important, in that connection, to note that all transmitters should be regulated, if any are to be regulated, for the purpose of reducing interference. To appreciate that, it must be realized that interference is created in at least two ways. The first is by the improper adjustment and operation of receiving stations, wherein a receiver inherently capable of discriminating between the emission of two stations, is not used to its effective limit, and therefore is unable, so far as its result is concerned, to discriminate and separate the interference. The second is the misadjustment of transmitting stations. The best transmitter, if not properly adjusted, will cause interference with the best receiver. The commercial companies to-day keep their transmitters at top-notch effectiveness of adjustment. One reason for that is that they must do so. The most important reason is that they must do so in order to carry on their business. The second reason is the restriction placed by the present law as to decrements. The naval stations should keep their transmitters in equally good condition, but so far as definite measurements have been reported to me, they do not do so. This is also for two reasons: The first that they are not required, possibly; and the second, that the operators do not appreciate, in general, the necessity of such correct and thorough adjustment.

One instance I may cite which has been brought to my attention is a comparison of the equipment at the Brooklyn Navy Yard and the National Co.'s similar station in Brooklyn. A measurement of the damping or lack of sharpness of the Navy's transmitter has shown a ratio of 40 to 3, as compared with the National Co.'s transmitter. That is to say, our transmitter has been and is operated at an adjustment which is over 13 times as selective as that of the naval transmitter.

One other point on the matter of interference. It has been stated that no receiving station could operate in the vicinity of a high-power station, regardless of the transmitter's wave length. We are near Sayville and Tuckerton, relatively near as regards the power of those stations, and we experience no difficulty with them. The Marconi stations experience no difficulty from them. The Navy itself has contradicted the testimony to that effect by bringing out, as Commander Todd did in his testimony for January 17, at page 137, that they are installing so-called duplex or remote control stations. I will explain that briefly. The duplex station, on this system, is an installation in which a receiver is located some 5 or 6 or 10 miles from the transmitter and is connected to the transmitter by a wire line. Because of the separation of 5 or 6 miles between those two stations, the receiver is able to keep in constant operation and to receive constantly, even though the transmitting station is sending out messages at the same time. If it were a fact that no receivers could operate when near-by transmitting stations were in use, manifestly the duplex operation, wherein the radiation of a power station is controlled by operating a key at a station 5 miles away, working in relays over the line-wire system, could never be applied. Yet Commander Todd has told us it has already been installed at Arlington, at Boston, and a number of other stations and is being put in in nearly all the high-power stations.

On the matter of wave-length restriction, there were some questions asked as to a policy of perfect freedom in the choice of wave lengths as contrasted to the policy of zones or groups of wave lengths reserved and set aside for specific interests. Mr. Clark, in his testimony for January 17, at page 130, has testified that the Navy was the first to adopt the entire range of wave lengths available in radio telegraphy, and says that by that adoption they have been able to put into effect a system which permits of calling on a single-wave length, which is standardized and set aside for calling; and thereafter when communication has been established, shifting either above or below that wave length to some other channel of communication in which there is no interference at the time. He has said that the adoption of that system has given the Navy great, or comparatively, great freedom from interference, as compared to the use of the ordinary or fixed wave-length system. He is absolutely right in that. That is the very best traffic arrangement. But it should be extended to all radio interests and not used only by the Navy. The commercial companies should have exactly the same degree of wave-length selection or freedom in wave-length selection; they should be able to call upon a standard wave length and arrange to effect their communication upon some other wave length, thus leaving the calling-wave length open for some other station which they are after, then change to the other wave length and carry on

their communication simultaneously and without interference. This matter of perfect freedom in the choice of wave length, together with a general agreement as to what wave lengths should be used, is the ideal method for preventing interference and taking full advantage of the present-day development of radio.

The matter of the reservation of wave lengths for certain interests is a thing which could be adopted if any interest, such as the Government, felt that it was incapable of securing sufficient freedom from interference by a simple choice of wave lengths determined by the conditions at the time of communication. And if they felt that for security they needed to have a certain place mapped out and reserved for their own communication which no other interest could occupy, they may follow the plan of the London convention, which the present law ratified and which set aside a reservation of from 600 to 1,600 meters for governmental stations. The Government stations occupy that range and use it with freedom from interference caused by the use of similar wave lengths by other interests. But they do not consider themselves restricted to that range, although that range is restricted for them. If a new reserved zone or set of reserved zones were decided upon there should be equal restriction upon all; that is to say, one interest should be given its line or set of channels of communication and another its set of channels, and the two should be mutually exclusive.

Mr. SAUNDERS. Just a moment in that connection. What do you mean by channels of communication to be set aside for different stations?

Mr. HOGAN. If we consider each wave length to be an equivalent to a telephone wire upon which a single set of communication can be carried on we can call that a channel of communication. It is a mere figure of speech.

Mr. SAUNDERS. That is what I want to get at. Each station having a separate wave length would have, in the view that you have taken, its own channel of communication.

Mr. HOGAN. Yes, sir. So much for interference in general. Any of these points as to the technical or semitechnical effects I should be very glad to explain in whatever detail any member of the committee may care to hear. The reason I am not going into it now is for fear I will waste time in repeating what has gone before.

The CHAIRMAN. What is the present condition of the art, or what is necessary in the further development of the art, to diminish or control interference?

Mr. HOGAN. At the present time we have excellent selection by wave lengths alone; that is to say, a transmitter which radiates a single wave length can communicate selectively with a receiver which is tuned to that single wave length. Five years ago that ideal was with us; we could do it to some degree, but nowhere nearly so effectively as it can be done to-day. However, that in itself is only one means of selectivity or isolation of a pair of stations which wish to communicate; and if two or three stations transmit on the same wave length in the same territory, manifestly a receiver which is attuned to that wave length must hear all of those stations; that is to say, mere tuning of the wave length is not a complete isolation of the interference difficulty unless a certain amount of freedom in choice of wave lengths is permitted and unless the apparatus is truly

selective; and, further, unless there are enough wave lengths for the number of simultaneous communications which must be carried on in any zone.

The future development is in two general directions. The first is still closer defining of selectivity by wave length; that is to say, whereas now a station would send on 600 meters and a station receive that signal at 600 meters wave length without hearing a signal of equal intensity but on 625 meters, in the future we may have, and wish to have, our wave length's selection so far developed that a station operating on 600 meters will not experience any interference from another station on 605 meters instead of 625. In other words, the increase in effectiveness of selectivity, or sharpness of tuning, is constantly growing. That is one direction of the art's growth.

Mr. SAUNDERS. That means increase in the perfection of your instruments?

Mr. HOGAN. Precisely, sir. A further increase and further direction of the development of the art's growth is in the matter of selection by other means than wave lengths alone. For example, I know of a test which was made that demonstrated the possibility of transmitting simultaneously three independent messages, and their simultaneous receipt without mutual interference, when all three transmitters used precisely the same wave length; that is to say, the selection was not made by wave lengths, because the same transmitting frequency was used in all three transmitters, but by another means.

Now, manifestly, so soon as we select by some other means we have tremendously increased the opportunity for selectivity, because that second means can be applied to every single wave length. Suppose we can tune to wave lengths 25 meters apart at the present time by wave-length selection alone, then in a range of 400 to 600 meters we have 400, 425, 450, 475, 500, 525, 550, 575, and 600—nine different channels of communication. That has permitted a certain degree of selection. Now, suppose on each one of those wave lengths it is possible to select by some other means five different messages, we at once multiply the 9 channels by 5 and secure 45 channels without changing the requirement of the wave-length selection. That sort of work is being done. The art is growing in that direction, and it is that sort of attack on the interference problem which will solve it. And it is that sort of attack which is being made by the commercial companies and is solving the interference problem for them. And it is because of the use of such modes of operation that you do not hear us coming in here to-day and crying about interference and asking you to close all naval stations so that we may operate comfortably.

Mr. SAUNDERS. In other words, it is the naval stations complaining of the commercial stations and not the commercial stations of the naval stations?

Mr. HOGAN. Yes; I think you will find that a fact from the testimony which has been given before this committee, sir.

Mr. SAUNDERS. Now, I would like to ask one or two technical questions along that line. What is the shortest wave length that is used in the operation of radio telegraphy?

Mr. HOGAN. The shortest wave length I have known to be used is of the order of 50 meters. That is used in actual radio communication as we practice it to-day.

Mr. SAUNDERS. It goes up into the hundreds.

Mr. HOGAN. It goes up into the thousands, to at least 20,000 meters.

Mr. SAUNDERS. Hundreds of kilometers.

Mr. HOGAN. Up to 20 kilometers or more.

Mr. SAUNDERS. Let me ask you this question in that connection: You said the stations could call each other by a wave of any agreed length?

Mr. HOGAN. Yes, sir.

Mr. SAUNDERS. And then shift to another wave length.

Mr. HOGAN. Yes, sir.

Mr. SAUNDERS. Can a receiving station that catches that, and finds out there is a message in the air, determine what is the wave length of that message?

Mr. HOGAN. Yes.

Mr. SAUNDERS. And be shifted on to that message?

Mr. HOGAN. Yes. This matter of calling on a single wave length and thereafter shifting to another wave length for communication is the ideal and can be practiced in the present development of the art, as Mr. Clark has testified. It is not practiced by the commercial companies because of the restriction placed upon them by the London Convention. Going to the technical side, to answer your question specifically, receiving instruments have adjusting handles or knobs which change the electric constants of the apparatus used. It is perfectly feasible (and it actually is done) to mark the scales and pointers attached to those knobs directly in wave length, so that a receiving operator on hearing a given station and setting his apparatus so as to give the loudest response to the incoming signal, can read directly at the end of the pointer the wave length in meters.

Mr. SAUNDERS. Let us take a receiving station, then. Of course, conceivably, there may be many messages in the air of different wave lengths. The station catches on to one of them, we will say, with which it finds it has some concern; can it determine what is the wave length of that message?

Mr. HOGAN. Yes.

Mr. SAUNDERS. We read in the newspapers a great deal about this interference. The receiving station, having thus caught on to the fact there is a message going in the air that it would like to interrupt or interfere with, can locate the wave length used in that message and then begin to send out waves of the same length?

Mr. HOGAN. It can.

Mr. SAUNDERS. And that makes it, I understand, more difficult at the receiving end for several messages of the same length to be in progress in the air than if those waves were of different lengths?

Mr. HOGAN. Yes; if I understand you.

Mr. SAUNDERS. I will restate it. If there are several messages in the air in which the waves used are all the same length, with reference to a receiving station that wishes to take in one particular message of that number, the difficulty of receiving it is increased by reason of the fact there are three or four or five messages in the same ether at the same time all of that same length?

Mr. HOGAN. Exactly so.

Mr. SAUNDERS. It is greater than if there were three or four or five or more messages in the air of different lengths?

Mr. HOGAN. Absolutely so. If they were of different lengths, by use of ordinary selectivity by wave lengths you would have no interference. If they were of the same wave length, those four or five messages, and you had nothing but selectivity by wave lengths, it would be absolutely impossible for you to distinguish between them. That is exactly right as you put it.

Mr. SAUNDERS. For the purpose, then, of willful interference it is necessary for the party seeking to interfere to ascertain the wave length of the message he wants to bother or interfere with?

Mr. HOGAN. Yes; within the limits in the direction of atuning that is absolutely a fact. A man sending out radiations upon that wave length—

Mr. SAUNDERS. Then, as I understand from what you tell me, it is possible with the instruments used to ascertain the wave length of the message with which you desire to interfere?

Mr. HOGAN. It is. That, of course, reflects immediately upon the preparedness aspect. If the naval stations send messages on a single wave length, and are accustomed to sending out on that wave length for the reason that they have no interference there, and an enemy's ship comes nearby, listens to that wave length, measures it, and starts radiations on that wave length, our naval stations are helpless.

Mr. SAUNDERS. That is what I was developing—that they would be at once in this trouble I gathered from your answers. Now, do I understand it is true in the art that if you send a message on a wave length, say, of 100 meters, the ether might be full of messages of 150 meters, and 200 meters, and 2 or 3 kilometers, and so on; but the fellow who is taking that message at the other end would not be bothered or interfered with at all?

Mr. HOGAN. Absolutely so; provided this wave length was a wave length of proper selectivity.

Mr. SAUNDERS. The art has advanced to that point?

Mr. HOGAN. Yes; it has advanced to that point, as demonstrated by the fact that the commercial companies are doing that very thing.

Mr. SAUNDERS. Then, the only way that anyone could be troubled in respect to interference is by loading the ether, so to speak, with confusing messages of exactly the same wave length as the message that is sought to be fooled with or confused?

Mr. HOGAN. Yes; and we are working, and have been working for some time, to prevent the possibility of even that; that is to say, we are working by definite-group frequencies so that, even with that malicious interference of the same wave length, it will be possible to communicate. In other words, we are getting away from the requirement of selection by wave length alone—we are calling into use other factors.

Mr. SAUNDERS. And as that develops along the line you have stated, then you will be able to eliminate this matter of malicious interference?

Mr. HOGAN. Very largely. It becomes vastly more difficult for the maliciously interfering station for the reason that he must not only determine one factor but also determine its combination with another factor. It is sort of a combination lock. I might say.

Mr. SAUNDERS. Which makes it more difficult?

Mr. HOGAN. Precisely.

Mr. SAUNDERS. Now, from what you tell me—having in mind the purpose of this sea signaling and that their wave length is standard, and that no other wave length can be used except that in that particular field—how can any of this other activity interfere with them in anywise?

Mr. HOGAN. It can not; even if they use the instruments now used by the commercial companies and handle them in the same way the commercial companies now do. I believe the naval apparatus is at least as good as the commercial companies' apparatus; but I firmly believe from my own experience with naval operators and our own operators, that the handling of that apparatus by them is by far inferior to the handling which it secures from the operators of the commercial companies.

Mr. SAUNDERS. The problem, then, is not one that calls, in that respect, for monopoly—the control by ownership and operation—by the Government; but simply for a regulation to be made in respect to the instruments in connection with the naval service, and, then, a proper degree of skill on the part of the operators who manipulate those instruments?

Mr. HOGAN. You are entirely right; sir. Moreover, not only does the problem fail to call for Government ownership as a remedy, but Government ownership is not a remedy. The proposition is equivalent to curing the toothache by cutting off a man's head.

The CHAIRMAN. That is, if that was all that was involved?

Mr. HOGAN. Precisely.

The CHAIRMAN. If a commercial company, having a monopoly of the art, should pursue the same policy, which you fear would be pursued by the Government, the result would be precisely the same, would it not?

Mr. HOGAN. If a commercial company ever should have the power which is given to the Government by this bill and should be as zealous in its use of that power as Dr. Kennelly and I feel the Government would be sure to be, as a matter of duty, certainly the same results would follow.

The CHAIRMAN. Their nature is very much the same. A monopoly on the part of commercial companies shows no greater public spirit or charity or philanthropy than would be exercised by the Government, is not that true?

Mr. HOGAN. You are quite right, sir; in so far as following the limit of its power is concerned, but—

The CHAIRMAN. Its power would be just as great if it had a monopoly, would it not?

Mr. HOGAN. I think not. There is no commercial organization, and never has been any commercial organization, which has been given or could be given the power given to the Government by this bill. I will point out just those portions of the bill which lead in that direction in a few moments. I have one other point to develop first, if I may.

Mr. SAUNDERS. I would like to ask first one other question for my own information: Do you agree with Prof. Kennelly in respect to the question I asked him, that, as a practical proposition, owing to

the fact that the ether is a vehicle of communication that is common to every commercial competing company, the likelihood that any one of those companies could obtain a monopoly of this art is most unlikely?

Mr. HOGAN. I do, sir. I think that is a fact which follows necessarily from your premises.

Mr. SAUNDERS. All these people have to do in respect to appropriating that vehicle of communication—they do not have to construct wires and all that sort of thing, but simply have to erect transmitting and receiving stations.

Mr. HOGAN. Precisely.

Mr. SAUNDERS. And then they are equipped and ready for business?

Mr. HOGAN. Yes, sir.

Mr. SAUNDERS. Now, in the commercial world the people who have in mind the use of and who do use the most delicate and sensitive instruments representing the latest development in this art will, of course, be the people who, with respect to their competitors, will have the advantage?

Mr. HOGAN. Indeed so.

Mr. SAUNDERS. Then there will be nothing there to head off the development of competing instruments to the same degree of efficiency, or ultimately a greater degree of efficiency? In other words, there is constant competition that will be free competition, that will be going on with all of these people who appropriate this field where they use this common vehicle of communication?

Mr. HOGAN. That is quite right. There can be, physically, no monopoly of the basic means of communication, which is the air, or what is in the air.

The CHAIRMAN. Right at that point, you are claiming too much virtue for these companies. If the Marconi Co., which is the strongest company existing to-day, and has more commercial stations, shall continue to develop, financially, as I hope it may, it can eventually shut out all competition by putting in stations and controlling rates, can it not?

Mr. HOGAN. No, sir; I think not.

The CHAIRMAN. Give the reason for it, if you can. I want to develop the whole matter.

Mr. HOGAN. Precisely. I do not want to attribute to any Government bureau things which are not to be expected of any man.

The CHAIRMAN. I am not assuming anything that is not well known. It is a fact in the commercial world that when any one company gets control or the monopoly of any commodity or any service, it can effectually shut out competition by controlling the rates; is not that so?

Mr. HOGAN. I fail to see any possible application of that to this case, because the premise is that it shall have control, shall have a monopoly of the commodity itself.

The CHAIRMAN. I do not care how many men may use the air; if they can not use it profitably, they will not use it at all.

Mr. HOGAN. But how can anyone get a monopoly of the commodity in this case?

The CHAIRMAN. Because if the Marconi Co. has a commercial station at a certain point and some other ambitious company under-

takes to put up another commercial station at that point, they can make it commercially unprofitable for them, can they not?

Mr. HOGAN. It will be equally unprofitable to the Marconi Co.

The CHAIRMAN. Oh, but they are strong, more powerful, and they can starve the other fellow out. Nobody of average common sense would want to invest a dollar in an enterprise like that.

Mr. HOGAN. In other words, the large corporation can, by diverting its profits from one point, pay for the loss at another is the point you wish to make?

The CHAIRMAN. Oh, yes; that was the process followed by the Standard Oil, by which it shut out competition.

Mr. HOGAN. That, as an abstract thing, might be applicable to this case. It certainly is applicable to the Navy monopoly proposed, but whether or not it could be applicable to a commercial monopoly that you suggest as a possibility, I do not see.

The CHAIRMAN. I am not arguing in favor of a naval monopoly.

Mr. HOGAN. I understand that, sir.

The CHAIRMAN. But I do not want you to gather to yourselves too much virtue. I do not think you are entitled to it.

Mr. HOGAN. I understand that, always, sir. I do not want to claim undue virtue for either side.

The CHAIRMAN. I expect you are equally selfish.

Mr. HOGAN. I think you are safe in saying that.

Mr. SAUNDERS. I am not impugning any particular virtue to anybody; I am trying to get at the basic facts and then seeking to deal with the situation through legislation when we get those facts. I assume the Government will be as selfish and greedy, for the purpose of argument in connection with this matter, as a great overwhelming monopoly, if it did succeed in monopolizing the whole field. But my question was designed first to show the difficulty of anyone getting a monopoly of all this field as is possible in any other field like the Standard Oil, through the possession of certain devices, certain equipment, and certain fields of oil, and so on; or a telegraph company after it had covered the country with a great body of wires so that any competing company then coming in would have to erect an equally great system of wires in order to come into competition with the telegraph company.

Mr. HOGAN. Yes, sir.

Mr. SAUNDERS. But here is a thing where the basic thing is free to all; you do not put a dollar into that?

Mr. HOGAN. No.

Mr. SAUNDERS. With respect to a great company, it is perfectly true, as the chairman suggests, that some great company might set up a great number of stations and might operate at a loss and by virtue of that brute force drive out any fellow undertaking to come in. But that is a situation that could be very easily met by legislation as far as that part of it is concerned.

Mr. HOGAN. Necessarily. But that is a condition that is almost inconceivable. We can assume a government monopoly on the one hand as against a complete commercial monopoly on the other hand, such as the chairman asked me to do a moment ago, and, giving them, by assumption, equal powers, and, then, I personally see no reason why we should expect the commercial monopoly to be less selfish than the Government, or vice versa. But first, there are two assumptions

there: First, the commercial monopoly must be secure before it could become harmful; second, it must have complete power before it could become harmful. Then, having that, it will be just as harmful as a Government monopoly if those two conditions should exist. But we do not have to make any such two assumptions in order to say, if a Government monopoly should exist it would be harmful; because we have in the proposed bill precisely the provisions which would set up such a powerful and complete monopoly.

Now, if you will bear with me a few moments longer, I have two other points which I would like to bring out, although if there are any further questions under this topic, it might be a good plan to cover them first. In respect to the case which has been set up by the proponents of the present bill, I merely wish to indicate that it is full of opinions. There are very few facts stated. Those that have been stated have been subjected, in large measure, to interpretations which are exceedingly strained.

Some interesting examples of contradiction occur. In the testimony for January 13, at page 70, Secretary McAdoo had read a letter in which he pointed out that he believed the development of radiotelegraphy would not be hindered by the enactment of this bill, but that, on the contrary, private enterprise would be stimulated to greater effort. What did he give as the reason for that? That the scientists of to-day engaged in the solution of radio problems are not as a rule connected with operating companies; consequently that the destruction of operating companies would not affect the scientific growth. Mr. Waesche, who read that letter to the committee at page 75 of the testimony of January 13, stated that he believed the passage of this bill would not interfere with the development of the art. Why?

Because the scientists of to-day, as I believe, are mostly with the manufacturing companies, as it is natural that they should be.

Capt. Bullard, on page 23 of his testimony for January 7, testified that anything would be an improvement on the present law. There has been ample testimony to the contrary. It has been shown that the only two features, in so far as the art is concerned, which flow from the act of 1912—except possibly for the details—arise from the wave-length restrictions enforced by the London convention. Now, in the matter of limiting or stifling—

The CHAIRMAN. Right at that point; limiting the wave lengths to 600 meters or less for commercial uses, and from 600 to 1,600 for the use of the Navy, are the provisions of the London convention, are they not?

Mr. HOGAN. The London convention provides that from 600 to 1,600 shall be set aside for the Navy or governmental use—the cream of the wave lengths, as expressed by Mr. Sarnoff. I think for ship working it fixes the ship work officially at 600 meters, although there has been some latitude by permission of our Department of Commerce, whereby we can use other wave lengths lower than 600 meters. But it is this requirement and this selection of the best working wave lengths which has handicapped the growth of the ship end of the radio art in the last few years. The decrement restrictions, selectivity violations, purity of wave lengths, and the other regulations of the law have worked out excellently under the regulation of the Department of Commerce.

On the matter of limiting or stifling of the art, long before anything was said by the opponents of the bill, the proponents began to apologize, to explain, that their proposition would neither limit nor stifle the development. Substantially every witness who appeared before you in favor of the bill apologized in this way.

The CHAIRMAN. I would hardly call it an apology, because the committee wanted to know what its effect would be on the art, and it would be their duty to say.

Mr. HOGAN. I will change "apologized in this way" to "made statements in this direction."

The CHAIRMAN. I do not think you ought to put them in the attitude of apologizing; that was the inquiry in the minds of the committee, and we wanted to know, because we did not want to stifle the art.

Mr. HOGAN. I am expressing my impressions and their attitude. Dr. Austin, in his testimony for January 17, at page 124, pointed out one reason which, in his opinion, would aid in the development of the art and would not be affected by the bill; that is, that all the manufacturers could continue to build apparatus for the Government. That, I may say—from my experience with a large manufacturing company, which has supplied many of the Navy stations, a large percentage of them—is inconsiderable. There is little or no profit for a commercial organization to be made from sales to the Navy under the present mode of operation. The independent manufacturers encouraged and fostered by the Navy Department—which fact was also cited by various witnesses—are, in general, parasites in the radio art. They have expended nothing in its development; they have their offices in their hats, and they prey upon the developers of the science by taking advantage of the unfortunate attitude of the Government which has been so clearly brought out by other witnesses in the matter of patent infringements. There have been numerous admissions of the stifling of the art by the proponents of the bill. Capt. Bullard, in his testimony of January 15, at page 108, said that he did not want the high-powered stations nor the manufacturers to be interfered with by the Navy, and that therefore he was opposed to the suggested amendment of this bill. And his reason was that this part of the art was in a state of flux; that continued improvements were being made in the high-powered stations; that they had not reached a state of standardization. On the same page 108 of his testimony for the same day he pointed out that the coastal end of the ship to shore communications might well be taken over by the Government. Why? For the reason that it had become standardized. In other words, that no further development was necessary.

Commissioner Ewing, in his testimony of January 12, at page 55, pointed out that he was opposed to Government ownership for the reason that it would always stifle and had always stifled scientific development.

Mr. Marvin, at page 92 of his testimony for January 15, discussed the matter of stifling the development as affected by the proposed bill and stated that in his opinion this bill would not stifle the art. Why? Because mere control and supervision would never stifle an art. He had entirely overlooked the ownership side. The present law provides regulation and supervision and has not stifled the development

of the art. Mr. Marvin was right, although he was wrong in not attributing Government ownership to the present bill.

Capt. Bullard, at page 112 of his testimony for January 15, when asked by Mr. Greene: "Has there been any development of sending and receiving apparatus by the Navy Department, or has that been done by private enterprise?" answered: "I should say both. At the Navy Department, we say what we want and ask these different people to furnish it, and they come as near to it as they can. We say that is not good enough; go off about your business and try to get something better; and they do." As Mr. Greene commented, "That is done by private enterprise rather than by the Navy Department itself." It is evident from the testimony which has come before this committee that the technical and scientific developments due to the Navy in itself have been substantially a very small part of the total growth of the radio art.

Mr. SAUNDERS. Just in that connection, of course, to anyone who was conversant with the art and the different phases of it and the different instruments such as have been invented and developed, it is very easy to say a particular instrument representing a development and improvement has come from the Navy. Of course, as one conversant with these things, you know what they have actually invented.

Mr. HOGAN. You are quite right, sir.

Mr. SAUNDERS. And I understand you to say that so far as anything coming from the Navy itself—from naval men—in the way of contributing toward the development of this art, there has been very little?

Mr. HOGAN. Negligible.

Mr. SAUNDERS. And what they are, of course, you could name them in this connection if you were asked?

Mr. HOGAN. I would have great difficulty in naming a single advance in the art which has been the undivided result of the Navy Department's scientific activities. They have made numerous detailed variations in adapting commercial apparatus to their peculiar military needs. Those, of course, are advances from their point of view. And it is that work to which the naval engineers are confined; but that work has had substantially no effect on the advance of the art as a whole.

The CHAIRMAN. It is rather in the application of the art to their needs, is it not?

Mr. HOGAN. Precisely, sir.

Mr. Hooper, at pages 114 and 115 of his testimony for January 15, pointed out that the Navy was slow to adopt new ideas, and he did not blame them for that, for the reason that they had particular conditions to meet and had great difficulty in maintaining a standard equipment aboard their ships.

Mr. Clark, at page 125 of his testimony for January 17, pointed out that the Navy always took whatever was best and newest, regardless of cost and regardless of the necessity of scrapping present equipment.

Both of those opposing "facts" were used to argue that Government ownership and monopoly would not stifle the art.

Another argument which was directed toward the development of the art was that advanced by Mr. Clark, on page 130 of his testimony

for January 17, in which he pointed out that the work of the Navy Department was open to all engineers in the radio field—that there was the utmost cooperation—that anything the Navy did could at once be availed of by the manufacturing companies, and that therefore, by cooperation and mutual endeavor, the art would succeed in reaching its best ends. That shows that the art would not be stifled by Government ownership.

Commander Todd, on page 134 of his testimony for the same day, pointed out that competition would not be stifled in the development of radio apparatus by Government ownership. Why? For the reason that the Navy was in competition with all the navies of the world. And as a corollary he said that of course it was necessary to keep secret everything which was done by the Navy in the development of radio apparatus.

It is because of this sort of thing that any remedy such as that proposed by the bill for interference, neutrality, and preparedness difficulties, which are stated to exist, can not fail to stifle the art.

Now there are some other points in connection with the testimony which should be explained. Mr. Todd, at page 135 of his testimony for January 17, and Mr. Hooper, at page 120 of his testimony for January 16, both stated it was necessary at this time to pass this bill, since it would prevent the growth of land stations operated and owned by commercial companies. Why? Because those stations in the course of a few years would be so numerous that nobody would be able to work at all. Now I may say what is to me an absolutely obvious thing and requires no statement—that is, that commercial companies are not in business to build stations; they are in business to live. There is an economic limit which is determined by the state of development of the scientific art, and that economic limit to the number of stations can not be exceeded and still permit the companies to exist. These stations are not propagated on the guinea-pig plan.

Mr. Clark, at page 126 of his testimony for January 17, stated that the Government was in a position to carry on extended researches which could not be followed out by commercial organizations, and cited as an instance of such an investigation the trip of the U. S. S. *Salem*, from here to Gibraltar, saying that that trip had been initiated by the department for the purpose of finding out whether or not the arc and the spark generators could be compared as to effectiveness—for the purpose of finding out which of the two systems (continuous waves vs. damped waves) was the better. As a matter of fact, that trip of the *Salem* was for the purpose of determining the effectiveness of the Arlington Station across the river here, which was supplied to the Navy by the National Co. It was the acceptance test of the apparatus. The arc test was purely incidental. This station, which Mr. Clark characterized as the highest powered station in the world at that time, was accepted by the Government as a result of that test. Further, that same test in which commercial apparatus, not owned by the Government, was installed and demonstrated to the Government officials, was the first introduction which the Government had to the effective operation of the National Co.'s heterodyne receiver, which is the interference-preventing apparatus referred to by Mr. Kintner in 1912, and again

yesterday, and which Mr. Clark, at page 127 of his testimony for January 17, points out has been adopted in hundreds of naval stations since and has been of the greatest assistance in increasing the certainty of their operations through interference and atmospheric difficulties.

Another point of fact which has been brought forward, and which should be explained or expanded, occurs at page 126 of Mr. Clark's testimony upon that same date, where he says that all companies except the Federal Telegraph Co. use spark transmission. The fact is that the continuous-wave transmission such as produced by the arc, which has now been demonstrated to be superior in every respect to the spark or damped wave transmission; that is to say, more effective, more free from interference—it is better in every way—is the type of transmission used by the Sayville station in communicating with Germany and by the Tuckerton station in communicating with Germany. And it has been installed in the Marconi trans-Atlantic stations, or at least in some of them, on the other side at this time, and is being installed, according to my information, on this side of the water. It is used in the new stations of the National Co., and it was the invention of and has been developed by the National Co.

One further point: There is a dispute among the interdepartmental committee, which has proposed this bill, as to what the bill means.

Commander Todd points out in various places that it brings the Navy into the position of owning everything in wireless, whether or not the amendment concerning the high-powered stations is made a part of the present bill. That has been stated time and time again at the informal conferences and here. It is pointed out that the Navy should own this arc, and that wireless is very different from wire communication, because of the fact that it uses the universal ether, and therefore must be controlled by the Government; not only controlled, but owned. And, by the way, Mr. Burleson, in his letter, at page 96 of the record, argues that wireless must be owned and controlled by the Government for the opposite reason—that is the same as the wire telegraph and telephone.

Capt. Bullard, at page 108 of his testimony for January 15, says: "Do not take over the high-power stations." He can not bring himself to agree with Commander Todd. He says, in effect: "Don't take over the high-power stations, because they can be developed. Take over the shore stations, because the apparatus has been standardized." That, of course, as I pointed out, is proof of the stifling influence of naval ownership.

That is interesting in connection with Mr. Clark's testimony at pages 13 and 14 of January 17, wherein he points out that the ship apparatus is not standardized and is continually being improved, and that the next step is the adoption of continuous waves for ship working.

The CHAIRMAN. Right at that point, on the ships at this time, do they not use the same standard type of apparatus?

Mr. HOGAN. No, sir.

The CHAIRMAN. What companies use different types of apparatus?

Mr. HOGAN. The spark apparatus has been largely standardized, but—

The CHAIRMAN. Is not that the kind used on shipboard now?

Mr. HOGAN. No, sir; not—

The CHAIRMAN. What kind is used?

Mr. HOGAN. The Federal arcs are installed on, I think, some 12 or 15 ships on the Pacific coast. I have not those figures at hand. Those are continuous wave generators and not spark generators. The results which have been obtained show the continuous wave generators to be very much superior to the spark generators not only for long-distance work but for ship work, and other companies have prepared and are installing them—the De Forest people, the General Electric Co., the Western Electric Co.; all of those have installed apparatus aboard ship which operates on the continuous-wave principle. And the operation has been shown to be markedly superior to the damped-wave apparatus, the so-called standard apparatus in use in recent years.

The CHAIRMAN. There has been a standard, then, up to recent years?

Mr. HOGAN. There has been a standard fixed by the art. The word "standard," as I used it there, applies to the best of the art. The best spark apparatus has been installed on a large number of ships within the past two years and has become, in one sense, the uniform equipment. And as that was being installed and replacing obsolete or nearly obsolete apparatus of another type—at least inferior apparatus of another type—so certain of it was being replaced by the new continuous-wave instruments. And I venture to say that by the time the continuous-wave instruments are installed there will be other types of generators which will take their place. In other words, it is unsafe to say anything in this art is standard in any branch.

The CHAIRMAN. The Marconi Co. use the spark system in all their stations now, do they not?

Mr. HOGAN. Not in their high-powered coastal stations.

The CHAIRMAN. They are beginning to adopt the arc system?

Mr. HOGAN. They are beginning to adopt continuous waves. In their ship stations they do use the spark apparatus; yes.

The CHAIRMAN. They control all the installations on shipboard now, do they not?

Mr. HOGAN. They have a large number of them. They have no control over the balance, of course.

The CHAIRMAN. The statement was made by Gen. Griggs, or some other representative of that company, to the effect that they control 98 per cent of the commercial business at this time. Is it not a fact, that they practically control all installations on shipboard?

Mr. HOGAN. I believe those figures must have been based on the number of ships equipped with radio of the entire world. In the United States I think there are something like 600 vessels equipped, Mr. Sarnoff?

Mr. SARNOFF. The Marconi Co. operates 500 ships of the United States, and there are about 600 or 700 equipped now.

Mr. HOGAN. That is to say, there are from 100 to 200 ship equipments which are not operated or owned by the Marconi Co. in the United States.

Mr. SAUNDERS. In that connection, if it can be stated briefly for my information, what is the difference between the spark wave and the continuous wave? I do not want to go beyond the scope of the

investigation, but if it can be stated briefly I believe I would like to know, for working purposes, what is the difference.

Mr. HOGAN. The spark wave is produced by a current set up by special apparatus and in such form that it dies away more or less rapidly. A spark is produced and this current is permitted to die away, and with each spark a set of waves is produced and dies away; then at certain intervals of time other sparks are produced or other groups or sets of waves are produced. The continuous wave, as contrasted to that, is merely what its name signifies. By a special type of apparatus waves are produced constantly, always the same size, and they continue so long as the transmitter is in operation and do not come at intervals.

Mr. SAUNDERS. There is no break of the continuous waves?

Mr. HOGAN. Precisely. It is the difference between striking a tuning fork at certain intervals of time and listening to the sounds die away as compared to listening to an organ pipe which operates so long as the organ key is depressed.

To continue with respect to the interpretation or understanding of the bill Messrs. Denning and Burleson, of the Post Office Department, in the statement beginning at page 94, seem to like the bill as proposed, except that they say that Government ownership must be in the hands of the Post Office and not of the Navy or Commerce Departments.

Commissioner Ewing, beginning at page 50, says, Take over the shore end of ship to shore communication. Why? "Because it will relieve the companies of expense and because they desire it." You will find statements to that effect in his testimony of January 12, at pages 51, 53, and 54. So soon as you take away that premise—that is, that the taking over of the commercial stations by the Navy Department is desired and will mean an economy to the commercial companies—you take away all of the arguments suggested by Commissioner Ewing. He said, at page 58 of his testimony, that the Government must not own the radio or it will hinder the art, but that it should regulate it. That brings us down to the present law. The present law does regulate radio, and, as I have pointed out and as some other witnesses have pointed out, is good except for such wave length restrictions as are imposed by the London convention, and possibly some other smaller points coming up in the same way.

In closing, I wish to point out how the proposed bill leads inevitably to the Government ownership of the radio—not only Government ownership, but Government ownership by confiscation—and how it does that even without the proposed amendment covering the purchase of high-power wireless stations. You need only refer to the power given to the Government by sections 5, 6, 7, 10, 17, and 20 of this bill, and consider the application of that power which must necessarily flow by the action of any zealous official, as Dr. Kennelly has pointed out this morning, in order to see that this bill gives the opportunity and the power for just such a harmful and unjust monopoly of radio telegraphy as has been discussed this morning.

On page 5, beginning at line 18, the Secretary of Commerce is given the power to approve the rates charged by all licensed stations open to public service, and it is pointed out that that does not mean merely to approve the rates, but to fix the rates. Further along, at the bottom of page 5, it is proposed that the Government

stations may be opened generally to public business and shall fix the rates for such public business.

It has already been explained at length how such rate competition can result in nothing but the elimination of the commercial companies, provided that the Government is willing to lose money faster than the commercial companies can afford. And of course that is exactly what can be done most easily under the methods of accounting used by the various governmental departments.

On page 7, line 7, it is provided that the Government shall have the power, through the Navy Department, to purchase "at a reasonable valuation" any coastal station now in operation in the United States which the owner may desire to sell. It is pointed out that there is no way of fixing the value; that a value put on mere physical apparatus at a station after it has been run into the ground by destructive competition will not compensate the owners. The provision is utterly dangerous.

Page 8, beginning at line 14, provides that a license shall not be granted to any station not in actual operation at the date of the passage of this act if, in the opinion of the Secretary of Commerce, the operation of the proposed station will seriously interfere with the existing Government or licensed stations in the vicinity. Of course that merely means that an application for a station license will be referred to the Navy or whatever Government department happens to own stations in the vicinity of the proposed new station, and the head of such department will be asked, "Do you think that this station will interfere with your station?" If he thinks so, then it, of course, becomes the opinion of the Secretary of Commerce that interference will be caused, and the station will not even be given a chance to demonstrate that it can operate without producing interference.

Page 12, section 10, beginning in line 23, states:

That any station license shall be revocable by the Secretary of Commerce, in his discretion, for violation of or failure to observe any of the restrictions and conditions mentioned in the preceding sections or other provisions of this act or regulation of the Secretary of Commerce—

There you have the power to take away the license of an existing station or to refuse to renew the license of an existing station. And on what ground? That a Navy station may have been interfered with, that a Navy station may be interfered with in the future, or that some regulation may be violated. Certainly that is unjust.

Page 18 provides, beginning at line 8, that every station shall use such transmitting apparatus that the energy is radiated in as pure and sharp a wave as practicable, and have a logarithmic decrement not greater than the limits which may be specified by the Department of Commerce. Benevolently administered, that provision is good. It is necessary, however, to put a limit—a numerical limit—upon logarithmic decrements and to state the regulations which must be met, unless confiscatory acts are to grow out of such a provision of the bill.

The CHAIRMAN. What would you suggest in that regard?

Mr. HOGAN. The present law.

The CHAIRMAN. You think it is ample?

Mr. HOGAN. Ample for present conditions. Page 19 provides that commercial stations—section 20, beginning in line 19—shall

use certain wave lengths, and that such a station shall operate in such a manner as not to cause avoidable or unreasonable interference with Government stations or other commercial stations. It does not say how this interference shall be determined to be unreasonable or unavoidable, it merely gives the power to close the station instantly upon receipt of complaint, provided it is decided arbitrarily that the interference is unreasonable. With no definition, such a provision is, of course, unfair. It may be said that no complaints leading to the closing of stations would be made based upon that. Very well, go to line 14, page 20, and read:

In considering complaints of interference and in deciding whether the license of a station causing serious interference shall be revoked by the Secretary of Commerce, preference shall be given to stations communicating with ships or between points where other means of communication are not available.

I think that shows an intent——

Mr. SAUNDERS. Let me ask, in that connection, a question or two which rather take us back over the ground we have traversed: Do I understand these high-power stations do not at all interfere with the ship communication? Of course, I can understand that theoretically they might, but, as a matter of fact, are they causing any interference?

Mr. HOGAN. My own experience is that no interference with ship working has been experienced from the high-powered stations, providing those high-powered stations operate as the Sayville, Tuckerton, and other important plants do. I do not say it is not possible for some badly used and badly operated high-power station to make some interference. It is theoretically possible.

Mr. SAUNDERS. That would only be by sending out——

Mr. HOGAN. The wrong kind of waves.

Mr. SAUNDERS. Waves of the length which are used in connection with sea signaling, if I understand what has gone before?

Mr. HOGAN. Yes.

Mr. SAUNDERS. But when they are not doing that they are not making interferences?

Mr. HOGAN. They are not making interference.

Mr. SAUNDERS. As a scientific proposition they are not interfering with sea signaling?

Mr. HOGAN. Quite so.

Mr. SAUNDERS. Are the amateurs interfering with sea signaling?

Mr. HOGAN. Since the present act has been administered, there has been very little interference from amateurs. There have been a few complaints, usually based upon the fact that some chap or other would occasionally, in experimenting on a matter, or for fun, actually make interference; but so long as the amateur stays within the allotted range as determined by the present law, interference is not experienced.

Mr. SAUNDERS. It does not seem to be regarded as interference, because the present bill does not seem to interfere with them and I was just asking as a matter of fact whether they would make interference. Now, sea signaling is confined to certain prescribed wave lengths, as I understand.

Mr. HOGAN. Yes, sir; 300 and 600 meters are the official wave lengths, and the Department of Commerce has permitted us the use of waves between those.

Mr. SAUNDERS. Now, if the high-powered stations are not interfering and these amateurs are not interfering, the only people, so far as our control would go, interfering with sea signaling would be some transmitting stations within our territory which are sending out forbidden wave lengths; that is, trespassing upon wave lengths which are segregated, so to speak, for sea signaling?

Mr. HOGAN. That is substantially correct; and such a transgression of the wave lengths is a violation of the present law and can be treated as a violation of the present law.

Mr. SAUNDERS. That is, they are sending out wave lengths which trespass, you might say, upon the wave lengths which are reserved for sea signaling?

Mr. HOGAN. By the present law.

Mr. SAUNDERS. By the present law?

Mr. HOGAN. Yes, sir.

Mr. SAUNDERS. Then, if those stations, whatever they may be, other than high-powered stations and amateurs, are not sending out forbidden wave lengths, there is no interference that would possibly emanate from our territory; and if the interference from the use of forbidden wave lengths came from an area beyond our territory, of course, we have nothing to do with it.

Mr. HOGAN. That is true.

Mr. SAUNDERS. Then, there can be no interference?

Mr. HOGAN. That is true, except one must always consider the possible defective operation of apparatus.

Mr. SAUNDERS. I was coming to that. Then, so far as interference being controlled, so far as we are concerned, it must be either due to transmitting over which we have no control, transmitting in our territory which is in violation of law, or else it must be the manipulation of apparatus on ships?

Mr. HOGAN. I believe you are quite correct, and those are things which are not touched upon by the present bill at all.

Mr. SAUNDERS. I want to get at what can be considered as the facts with which we can deal as facts.

Mr. HOGAN. I think you have summarized that situation correctly.

Mr. SAUNDERS. I wanted to see if I had gathered the grounds of the statement in the main.

Mr. HOGAN. I think you are quite right, sir.

There is one further point in contrasting a monopoly by a privately owned company with a monopoly governmentally owned, and that is even though all the assumptions be made—First, that you could secure a private monopoly of radio in spite of the freedom of the air and lack of investment in plant, and so on; second, having that monopoly (or rather, if you had the conditions tending toward that monopoly in the matter of erecting stations) you could run other people out of business and prevent the erection of new stations—if you make both of those assumptions, you still have in favor of a private monopoly the fact that inventors would be encouraged by a private company in a way which the Government never has done and never would do so far as any communication has gone.

Mr. SAUNDERS. Would this be true scientifically? It would seem to be a corollary of what we have already gone over, that if you had a station at every mile on the Atlantic coast, sending out waves of a length of 10 kilometers, they would not be interfering with naval signaling?

Mr. HOGAN. I have, like some of the other men here, learned—

Mr. SAUNDERS. That might be hard, as a matter of generalization to answer; but so far as you have gone, would that be true, that a multiplication of stations sending out wave lengths above those segregated for sea signaling, would not cause interference with sea signaling?

Mr. HOGAN. I have learned some things about naval operation since I came down and listened to the testimony on this bill that I would not have believed, in the matter of interference; and I would hesitate to say that any transmitter can not interfere with any naval receiver, operated as they appear to be operated, as shown by some of the testimony which has been given to you gentlemen. However, I will say flatly that a commercial station, operated as a commercial station is, on a lower range of wave lengths, a shorter range of wave lengths, for point to point communication and ship to shore communication, would not even know transmission was being affected upon wave lengths of 10,000 meters, such as you suggest, even though the air was full of messages being sent upon that wave length.

Mr. SAUNDERS. I used that merely for the purpose of illustration to know what multiplication of those transmitting stations would be possible, and not interfere so far as they kept outside of the limits for Navy signaling.

Mr. HOGAN. You are quite right. So long as the apparatus was properly used, without any stretch to any ideal of the future, but considering the practice of the commercial companies to-day and the practice which I had thought was that of the Navy, you do not have to go any further than the art has taken us now to have such freedom from interference as your question suggests.

Mr. SAUNDERS. That is all.

Mr. HOGAN. I merely wish to say that having summarized this and taking these points in connection with the points brought out by other gentlemen, it seems to me that the new bill has been shown futile in the matter of preventing interference, as tending to preparedness or the settling of neutrality difficulties; and that the only logical course is to drop the proposed bill and stick to the present law. (See letters on interference conditions from operator in charge of Brooklyn Station, appearing at p. 316.)

(Thereupon, at 12.50 o'clock p. m., the committee adjourned to Tuesday, January 23, at 10 o'clock a. m.)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, D. C., January 23, 1917.

The committee met at 10 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. I understand from Mr. Penfield that he desires Mr. Davis to be heard.

STATEMENT OF GEORGE S. DAVIS, ESQ., GENERAL SUPERINTENDENT UNITED FRUIT CO., WIRELESS DEPARTMENT, NEW YORK, N. Y.

Mr. DAVIS. Since the introduction of the bill, H. R. 19350, which, as Commander Todd stated, suggests Government ownership, the question of actual Government ownership of all coastal commercial stations and high-powered wireless stations in the United States and its possessions has been strongly indorsed before this committee by military and other governmental authorities, and, as this is a far more important matter than the bill itself, we wish to comment on it first.

After having invested an enormous amount of money in establishing a wireless system of communication, which not only has proven a boon to shipping in general in the Gulf and Caribbean Sea, but connects the United States with Central and South America as well, we are quite naturally very much concerned over anything which would in any way interfere with this service or prevent our receiving the legitimate returns which we had a right to expect when we undertook to establish the system as a whole.

The entire system of the United Fruit Co. throughout Central and South America is dependent on a relay point at Swan Island, Caribbean Sea, to connect with a United States terminal at New Orleans, which is owned and operated by an affiliated company, the Tropical Radio Telegraph Co. Government ownership, as has been advocated before this committee, contemplates the taking over of this relay point and terminal, and we are frank to say that such action with respect to either or both of these stations may result in our having to abandon our system of stations in Central and South America as a whole, for the reason that their usefulness to the fruit company would be very seriously impaired by losing control of the relay point or of the terminal point in the United States, which is now, after a period of over 10 years, just beginning to be in a position to produce enough revenue from the establishment of a commercial service to pay the cost of operation and maintenance.

If these stations are taken over by the Government it means that our proportion of the total through rate, which does not now exceed and in most cases is under the cable rate, would be very materially reduced on account of having to pay the Government an additional proportion of the rate. This class of traffic can not stand a higher rate, and, if it could, the higher rate could not be worked out advantageously because of cable competition. To reduce our proportion of the present rates would not warrant our developing this service any further, and the proportion which we would receive under Government ownership would not take care of even a reasonable portion of the cost of operation and maintenance of the other stations of the system. This, however, is in a way incidental to the purpose for which the principal stations were primarily erected; that is, to provide a thoroughly reliable radio service to and from the ships of the United Fruit Co.'s line, as well as to and from that company's tropical divisions, which it is necessary to have on account of the highly perishable nature of the principal commodity handled and for the purpose of handling its business in general.

I might add here that in the development of its business in Central America the United Fruit Co. found it absolutely necessary to have its own means of communication in order to handle its ships and cargoes promptly. Of course we have the cable from the United States to points in Nicaragua (San Juan del Sur) and Colon, Panama, but those cables connect with Government-owned land lines to Central American points, and the service over these Government-owned lines is in the main so poor that we can not depend on it for the handling of ships. This is particularly true in certain parts of South America, where it sometimes takes 24 to 48 hours to get a single message through.

The CHAIRMAN. Does the wireless system of the United Fruit Co. do a general commercial business?

Mr. DAVIS. We have not made a business of soliciting commercial business. The commercial business we have handled and have been handling for the last few years has been for the accommodation of shippers and to the people doing business in Central America. We have during the past two or three years received requests from firms in the United States, some of them as far west as Kansas City, doing business in Central America, that we undertake to handle their messages to Central America on account of the poor cable-line land service.

The CHAIRMAN. Do you do business for the public generally or simply for your own people?

Mr. DAVIS. We now do it for the public generally, sir.

Government ownership is being advocated for the following reasons: (1) Military necessity, (2) preparedness, (3) difficulty in enforcing censorship regulations, (4) reduction of interference, and (5) to facilitate radio work in general, to and from ships at sea in particular.

Taking up first the suggestion of Government ownership as a military necessity, I wish to say that so far as Government ownership being a military necessity is concerned we realize that there are very often occasions where military necessity arises about which we can have no knowledge and are not in a position to question; but it does not appear, nor has it been brought out, that any necessity, military or otherwise, exists in this case.

In case of public peril, either real or threatened, the Government could take over the stations and their personnel without any further authority than they now have; but if there is any question about their having such authority, we are ready to enter into a contract with the Government which will give them the necessary authority in time of public peril, either actual or threatened.

In regard to preparedness, we, of course, are not prepared to make any comment upon the question of whether the Navy or any other department of the Government have a sufficient number of competent men to man all or part of the stations which it is proposed be taken over, nor do we attempt to say that in the event of the existence of such a shortage they could not in time recruit enough men. But so far as being prepared in case of war is concerned, we submit that while military training is desirable, it is not an absolute necessity in the case of wireless operators, and it is our humble opinion that in the event of war the country would be better prepared by having

an army of experienced civilian radio operators to call upon rather than the limited number of military operators which will be available under Government ownership.

Commander Todd has stated that in the event of war one of the first acts of the Government would be to close up most of the commercial stations; we submit that those stations will nevertheless be available for use in the event of anything happening to a Government station.

The Government now has a fairly large station at New Orleans. We also have a large station there, and the Marconi Co. have a smaller one. To better illustrate our point on preparedness we wish to cite an incident at New Orleans two years ago when that city was cut off from communication by wire on account of a hurricane. This hurricane dismantled the antennæ of the naval radio station, which put that station out of commission. It also put the Marconi station out of commission for some reason or other. The only station left intact was our own, and the only means of communication with New Orleans for several days was by means of our wireless. Of course, it might have been our station which had gone down instead of the Government or the Marconi station, nevertheless if New Orleans had been dependent upon the Government station alone they would have been without communication for several days. We do not mean by this to infer that the Government is in any way to blame for the failure, but we do submit that New Orleans was better prepared for just such an emergency by having more than one wireless station than would otherwise have been the case.

The same thing may happen in time of war, and although as Commander Todd said, certain of the commercial stations may be closed, we submit that it is better preparedness to have something to fall back on rather than to depend upon a single unit.

Citizen training camps, such as Plattsburg, were established and are maintained, probably at quite an expense, in order to prepare citizens to serve with the military arm of the Government in time of war. I do not know that the Government has asked, but they nevertheless receive cooperation from a large number of big business concerns in the training of men at Plattsburg, and we also submit that it is equally as important to have trained citizen wireless operators as it is to have trained citizen mechanics or artisans of any kind. Part of such training can of course be had on board merchant ships, but the most valuable training is received at the commercial stations and without expense to the Government.

In dealing with censorship regulations we are dealing with facts and not theories, and we are now operating under very strict censorship. We appreciate fully the circumstances under which censorship is imposed. The fact that it is impossible to send coded messages from a point in the United States to neutral countries without its having to be censored seems a hardship, but we have nevertheless given the Navy Department our hearty cooperation in carrying out its censorship regulations, and regardless of whether a censor is at the station or not do not send messages about which there is any doubt even though destined to a neutral ship or to a neutral country, or to a United States ship, without first having secured the permission of the censor.

Unless the Government permitted the operators to exercise their own discretion in matters of censorship, it would be necessary to place a censor at each Government station the same as is done at each commercial station, and certainly it is no more difficult for a censor to exercise his authority at a commercial station than it is at a Government station. It is quite reasonable to assume that the commercial operator will be just as discreet as the Government operator in the matter of interpreting censorship regulations. The commercial operators are trained from the beginning to observe absolute secrecy above everything else. That is part of the unwritten law of telegraphy, and I believe that the commercial operators are as competent to exercise discretion as the Government operator would be in a similar position. The point I am making is that the Government would have to place a commissioned officer or a warrant officer as a censor at their own stations in time of war or allow their operators to exercise their own discretion. And it is no more trouble, it seems to me, to place their censors at commercial stations than it would be at a Government station.

So far as Government ownership eliminating interference is concerned, we would point out that interference, aside from that caused by statics, is the result of two things, viz: The sending of messages and the law itself—the law requiring that every ship be tuned to a certain wave length and every shore station, when communicating with a ship, to use that wave length. We are not unmindful of the fact that the law provides that a ship may use 1,800 instead of 600 meters; but it is obvious that in most cases 1,800 meters can not be used to advantage with the existing type of apparatus on the average ship.

That interference is one of the principal problems to be overcome is not disputed; but the mere fact of Government ownership is not going to materially reduce it. Because, as said before, interference is caused first by the sending of messages, and Government ownership would not reduce the number of messages to be sent in any given locality, nor will Government ownership change the law by which all ships and stations are compelled to communicate on the same wave length.

The mere fact that the problem of interference is yet to be overcome lends incentive to inventors and investigators in the hope of hitting upon something which will eliminate it and from which they can receive a large return from both commercial and Government interests.

Mention has been made at this hearing of "duplication of effort," and it was brought out, I believe, that in such duplication the public pays the bill. In this connection it is only necessary to mention that the Government itself requires "duplication of effort," or, in other words, "competition." If we apply the argument about duplication of effort to the oil or other industries, we find it is only by duplication of effort they are permitted to continue in business. It might be said that the maintenance of more than one steamship line to a given port is "duplication of effort," and should therefore be discouraged for the reason that the public pays the bills. Duplication of effort is competition; and competition is not only the life of trade but makes efficiency and service, and these last two are what the public demands regardless of cost.

To facilitate radio work in general, to and from ships at sea in particular: No one questions but that the complete elimination of interference would facilitate radio work, but such elimination must come—as it has been coming for the past 10 or 12 years—by the development of science, due to keen competition and the hope of large returns by scientists and inventors which warrant their spending considerable sums in making experiments, rather than through control by any single administration or company. But supposing that all wireless stations were under one control, interference would nevertheless be present, for the reasons which we have already stated, and also the reason that most interference is caused by the ships themselves. Even in localities where there is only one station—Cape Hatteras, for example—the interference caused by a number of ships trying to get their business through one station is so great that it quite frequently happens that ships must wait for hours at a time before getting their messages through. It is our opinion that another station in the vicinity of Cape Hatteras would facilitate the handling of ship messages, regardless of the fact that several ships would be sending at the same time. This, of course, might necessitate a change in the law which would permit ships to use wave lengths other than those prescribed by the international convention and the United States laws and by the law which compels a ship to communicate with the nearest coastal station, but the point to bear in mind is that the work from ships at sea in general would not be greatly facilitated by having a limited number of shore stations, and, furthermore, that the incentive for the development of apparatus which would eliminate interference and permit any number of stations to work at the same time in a given locality would be largely removed by enacting laws which absolutely prohibit competition and give control to any one administration or company.

Mention has been made before this committee that this legislation would retard the art of radiotelegraphy; and in this connection we are not prepared to say that Government ownership would entirely eliminate the development, for it is a well-known fact that the Government does purchase new developments and that the officials in charge of the administration of wireless affairs of the Government are, without doubt, sincere in their efforts to do all they can to further the development of the art. They, however, are limited by law, and, as I understand it, are not free to go out and purchase apparatus from whomever they please. They must first draw up specifications and invite bids from the manufacturers, and I believe it is true that this sometimes places the manufacturer, who has spent a great deal of money in developing some particular apparatus, at a great disadvantage. In the commercial field it is different. If a new piece of apparatus is brought to the attention of a commercial operating company, such as ourselves, and there is no doubt that it will facilitate our work, we are in a position to buy it outright. It therefore seems obvious that any legislation which would restrict or in any way limit the markets of manufacturers and inventors to one administration or company would have a tendency to stop development.

We are not unmindful of the fact that this legislation would not in any way change the status of manufacturers or other concerns, so far as ship apparatus is concerned, or manufacturing for export:

and the very fact that it does not touch this field would have a tendency to influence, and probably would influence, manufacturers to devote all of their energy and engineering talent to the development of ship apparatus which is, as a rule, of lower power, and in consequence, as compared to the development of shore-station apparatus of higher power, is of relatively small importance both to the Government and commercial interests.

I do not think that anyone will deny that the erection in the United States of what would be the largest and most powerful wireless station in the world would be both a benefit to the Government in time of war and of the utmost importance to the commercial development of this country; and it may interest this committee to know that such a station was under serious consideration by one of the largest corporations in the United States, and they are now about to abandon the proposition on account of the legislation which is here proposed.

The CHAIRMAN. What company is that?

Mr. DAVIS. I do not feel at liberty to mention it in open hearing. I would be glad to give you the name privately.

The CHAIRMAN. Very well; I will not press it.

Mr. DAVIS. From a preparedness standpoint, the United States would certainly be in a much stronger position by having this immense station with a corps of trained men who could be called upon in time of war. Suppose that this project is abandoned, and that this legislation goes through; and suppose that the United States would then become involved in war with some other nation, and that Arlington or some other high-powered Government station, or one on which we were dependent for communication, was blown up or became disabled; would not the country be better prepared by having this large station, or other large stations of a similar character, to fall back upon in just such an emergency?

I believe it has been intimated before this committee that the commercial companies are not as progressive as they might be, and that their ships and stations are not equipped with modern apparatus. Certainly the United Fruit Co. has been equally as progressive as the Government or any other company in this matter. The United Fruit Co., for example, was the first to undertake complete storage-battery installations as auxiliaries to operate both the wireless and the emergency lighting systems on board ships, and this work was under consideration, and a greater part of it had already been undertaken, before the laws and regulations in regard to such auxiliaries were enacted. The United Fruit Co. was among the first, if not the first, to take advantage of the developments of Prof. Fessenden of the 500-cycle transmitting outfits, which every company, including the Government, later adopted.

Mr. RODENBERG. Can you state, approximately, about how much the United Fruit Co. has invested in its wireless service?

Mr. DAVIS. Something around two millions of dollars, roughly; that is, since we started in 1903, when the first station was erected in Central America.

The CHAIRMAN. How many stations have you?

Mr. DAVIS. We have now 10 shore stations, in addition to our ship stations.

The CHAIRMAN. One station in the United States?

Mr. DAVIS. Two in the United States, sir; one at New Orleans, and one at Burrwood, La., at the mouth of the Mississippi River, Southwest Pass.

The CHAIRMAN. Where are the others located?

Mr. DAVIS. One is located in Colombia, one in Costa Rica, one in Panama, one in Nicaragua, one on Swan Island, and two in Honduras.

Mr. HOGAN. And one in Cuba.

Mr. DAVIS. That will come up for discussion later in connection with another section.

The United Fruit Co. was also among the first to adopt the self-supporting steel towers for shore stations which are now almost universally used. We now have under contract high-power stations which, when completed, will probably be more modern than any other station in the country, including those of the Government; and I say this not as a reflection on the Government but because their stations are already contracted for, or a good part of them are and some installed; whereas we, in these stations, will have the benefit of the developments which came subsequent to the letting of the contracts by the Government. True, a year or two after our stations are completed the Government may have something even better; but the point I wish to make is that we do our best to keep abreast of the times and are equally as progressive in that way as the Government, or at least we hope we are.

I have already mentioned the matter of communicating with ships in the Gulf and Caribbean Sea, and in this connection wish to add that the United Fruit Co.'s system of stations furnishes the only means of wireless communication to points in the United States from the Caribbean Sea other than that furnished within a limited area by the naval station at Guantanamo, Cuba, and within a still more limited area by a station at Bowden, Jamaica. I believe there is also a Government station on Porto Rico, but that covers more the South Atlantic than it does the Caribbean Sea. At least that is my understanding.

These stations, as I said before, all have their outlet in a high-powered station at New Orleans, which the Government now proposes to take over, and we wish to remind the committee that we were the pioneers in establishing this means of communication and have developed it to a point where it is indispensable to shipping in the Gulf and Caribbean Sea, and that now, after spending enormous sums of money in this development, we should be left to enjoy the legitimate profits which will result from this development and from our foresight in undertaking it when the commercial returns, as well as its usefulness as an adjunct to the fruit company as a whole, was a question of serious moment.

Until the establishment of this system of stations by the fruit company there were no adequate means of getting information to the Weather Bureau in regard to storms or approaching storms which cross these waters at certain seasons of the year. I refer particularly to the hurricanes which pass up through the Caribbean Sea and the Gulf during the late summer months, and which have proven so disastrous to shipping and to the cities of New Orleans and Galveston and, in fact, to the entire Gulf coast. It is almost entirely through the fruit company's system of stations (and I think that the

Weather Bureau will bear me out in this statement) that they are enabled to receive these observations in time to issue warnings which have saved millions of dollars in shipping in the Gulf and Caribbean Sea. True, there is still room for improvement in this service, and we are taking steps to the end that these "observer" messages on which the Weather Bureau bases their forecasts can be dispatched from any point in the Caribbean Sea to New Orleans, and thence to Washington in the shortest possible space of time after they are made. Some of these messages are sent in via the naval station at Guantanamo, but the great majority come in through stations of the fruit company's system.

We do not wish to claim all of the credit for furtherance of this work, but we do wish to point out to the committee that no more facilities than we now offer through the stations to the Government would be possible under Government or any other control. It is the development of the fruit company's system which has made the extension of activities of the Weather Bureau in the Gulf and Caribbean Sea possible; and as further evidence of the importance of maintaining this system as a whole to the end that these facilities may be retained for the benefit of shipping on the Gulf coast, the Weather Bureau to-day have a representative traveling in Central America with the idea of establishing observation stations and appointing operators as observers.

Practically all of the hurricane warnings which have been posted along the Gulf coast and sent broadcast to shipping in general were, in the main, based on messages sent through our stations. And while, of course, it may be said that on account of our shipping activities it is of great value to us to get these observations to the bureau in time to permit the issue of storm warnings so that our ships may make safe ports, it is nevertheless of equal importance to all ships and of particular importance to the entire Gulf coast of the United States.

These statements are made not with the idea of reflecting credit to ourselves, but to impress this committee with the fact that these facilities were made possible only through the development of the United Fruit Co.'s system of wireless stations, and that Government or any other ownership is not going to increase these facilities in any way. We are giving now and will continue to give the Weather Bureau, as well as all other departments of the Government, our hearty cooperation, and we submit that the best way to overcome all of the obstacles which have presented themselves is not by arbitrary legislation but by close cooperation and a better understanding between the Government and commercial companies. In the end, the Government is almost entirely dependent upon commercial resources in time of war, and the greater the development of commercial resources the better is the country prepared.

I want to add here, in regard to the subject of interference, that the Navy goes out every year for battle practice, or target practice. During that practice the ship is rolled and physical conditions are made just as hard as is possible for the gunners to hit the target. In other words, they try to duplicate adverse conditions so that in war when those conditions are actually encountered the gunners will be used to them. It seems to me the same principle could be advantageously applied to wireless operations at the Government ships

and stations. At least, it would do no harm for the operators to be trained right to the minute to overcome all obstacles in the way of atmospheric interference or interference by stations. I do not think anybody will deny the United States Navy is far ahead of any other navy in the way of wireless, as well as other equipment, and that our American operators can work faster and better (more accurate) than foreign operators, or the big majority of them. That may be largely due, and I think it is largely due, to the fact that in Europe the operators have had "a bed of roses" (the result of laws) to lie in, while our operators have had to fight for everything they get. And I think that competition in that way makes them even more efficient than they can be made by legislating interference out of the way.

In opposing this legislation we are, much against our wishes, placed in a position of opposing certain departments of the Government with whom we have had most cordial relations and with whom we are now, and I hope we will always continue to be, in close cooperation, to the best interests of all concerned. We hope that we have made clear that whatever we have had to say about this legislation is in no way meant as a reflection on any department of the Government, any Government officials, or the stations or apparatus under their control. The improvement in the Government wireless service under the able direction of both Capt. Bullard and Commander Todd has been very marked. Commissioner Chamberlain, in his administration of the present law, has been most eminently fair, and his policy has been as big and broad gauged as could be desired. We have, however, an honest difference of opinion with these gentlemen and others who are in favor of this legislation, and we hope that we have shown the committee that this opinion is well founded and worthy of serious consideration. We have other very strong and sufficient reasons for protesting against Government ownership, but, as these reasons are based upon communications of a confidential nature, we do not feel at liberty to mention them in open hearing. We therefore request that the committee hear us in executive session, at their convenience, when they will be stated in full.

So far as the proposed bill—H. R. 19350—is concerned, there are certain features of the bill which would not affect us in any way, and it would therefore not be consistent for us to mention them. However, when the interdepartmental committee which drafted the bill called a meeting of the various commercial interests to consider it, we offered certain amendments. Some of these were incorporated in the bill as it appears at this time and some were not. And, for the information of the committee, I will submit a copy of the statement made to the interdepartmental committee a month or two ago by our affiliated company, the Tropical Radio Telegraph Co.

If it is the sense of the committee that legislation along the lines indicated in the proposed bill is necessary at this time, we believe that certain of the amendments which were rejected by the interdepartmental committee should be incorporated in the bill, and therefore beg leave to submit to the committee those suggestions for incorporation in this bill, provided, of course, that the committee favors Government ownership at this time.

(The amendments referred to will be found at the conclusion of Mr. Davis's remarks, p. 292.)

Mr. SAUNDERS. I would like to ask one question—you may have discussed this before I came in—with respect to this problem of interference with sea signaling. Would that problem be made easier and interference reduced, in your judgment, by giving the Government a monopoly in the ownership and operation of wireless telegraphy?

Mr. DAVIS. No, sir; I do not think so.

Mr. SAUNDERS. Of course your company must have had a good deal of experience with this interference, as much, I should imagine, as any company in the world, having been in operation for some years past. Have you had those difficulties which have been suggested as being so serious by the spokesmen for the Government.

Mr. DAVIS. I think we have all had our troubles and difficulties with interference. I do not think that control by any one company or any one particular department of the Government is going to solve the interference problem. In the early days of wireless, back in 1903, 1904, and 1905, we suffered materially from interference. And the reason to my mind and to the minds of a good many others, I believe, why this interference has been overcome was simply due to the fact that a means had to be found to get around it. In those days we used what we called the coherer, and it was next to impossible for any one station within 75 or 100 miles of another to receive their messages through interference from any other station at a similar distance. And that led partially to the development of the apparatus we are using to-day, which does permit such messages to go through.

Mr. SAUNDERS. Can the results that have been accomplished, then, be said to be due in part to the development and perfection of your instruments and a better scientific knowledge of the basic principles of wireless telegraphy?

Mr. DAVIS. Yes; I believe so.

Mr. SAUNDERS. The solution having been approached in that way rather than by legislation or by departmental regulation?

Mr. DAVIS. I believe so; yes, sir. At least that is my opinion. Of course regulations and administrative matters which are purely between Government departments and the Government and commercial companies are always helpful.

Mr. SAUNDERS. But that is not the major part. What I am trying to ascertain is whether that is the major part of the problem or whether a development of the knowledge of the art and improvement of the instruments is the major part?

Mr. DAVIS. The development of knowledge of the art and improvement of the instruments is the major part. That is the fundamental principle on which I think this problem of interference should be worked out—the development of and progress in the art.

Mr. SAUNDERS. I believe that certain wave lengths or wave lengths between certain limits have been prescribed for sea signaling.

Mr. DAVIS. Yes, sir.

Mr. SAUNDERS. That is true, I believe?

Mr. DAVIS. Yes, sir.

Mr. SAUNDERS. That being true, as a practical proposition, to what extent are you interfered with by messages using waves of lengths

other than those prescribed for sea signaling? Are you interfered with at all?

Mr. DAVIS. There is some interference on those wave lengths by the larger stations due to forced oscillations in the antennæ. But the recent developments—in fact, quite recent developments—have shown we have very greatly reduced that. As I said in my statement here a moment ago, the law itself aids interference by requiring everybody to be on one wave length.

Mr. SAUNDERS. You mean in sea signaling?

Mr. DAVIS. In sea signaling; yes, sir. For general public service all ships at sea must use 600 meters, and it is my contention, and always has been, that ships should be allowed some range rather than have a definite, fixed wave length.

Mr. SAUNDERS. That is what I undertood and, in fact, one of my questions contemplated you did have certain limits.

Mr. DAVIS. We must use 300 meters, 600, or 1,800 meters. The use of 1,800 meters is not practicable on the smaller ships. Three hundred meters is almost equally as impracticable. So that it narrows right down to 600 meters—one wave length.

Mr. SAUNDERS. While apparently you have a range of wave lengths, as a matter of fact, in the actual practical operation of the business, you do not have any such range?

Mr. DAVIS. You are quite right, sir.

Mr. SAUNDERS. You are driven from what you say, to use the 600-meter wave lengths?

Mr. DAVIS. Yes, sir. And, of course, that is a provision of the International Convention in London, in 1912.

Mr. SAUNDERS. I understood from experts who have preceded you that interference is really because of messages, other than the ones you are concerned with, using the same wave length as the message you are trying to detect?

Mr. DAVIS. Yes, sir.

Mr. SAUNDERS. So that in thus holding you down, in sea signaling, practically to one wave length, you are really increasing the interference?

Mr. DAVIS. Yes, sir; exactly.

Mr. SAUNDERS. Therefore instead of having a Government monopoly in this direction, we ought to give more flexibility in the matter of using the wave lengths?

Mr. DAVIS. That is our desire, to get the wireless service flexible so that we can eliminate through cooperation in administrative matter as much interference as possible. The development of the art will ultimately eliminate all interference, the same as the development of the art eliminated interference in land wires—in the telephone and telegraph wire.

Mr. SAUNDERS. That has been achieved, has it, in the land wire?

Mr. DAVIS. Yes, sir.

Mr. SAUNDERS. And you are tending in that direction now in the wireless?

Mr. DAVIS. You are quite right; yes, sir.

Mr. SAUNDERS. And as I understand, from my reading of it, you have made great strides in that direction in a comparatively short period of time?

Mr. DAVIS. The greatest strides have been made in the last four or five years; because it was only after the advent of detectors, of apparatus other than the coherer apparatus, that wireless was at all efficient.

Mr. SAUNDERS. But your interference in this sea signaling, then, to repeat, somewhat, the question I have already asked, is not from other stations using different wave lengths, but is really due to the fact that all of your signaling is confined to one wave length.

Mr. DAVIS. You are quite right, in the main.

Mr. SAUNDERS. It is not from other stations using different wave lengths, but the multiplication at sea of the number of facilities and shore stations using the same wave length?

Mr. DAVIS. That is the idea. Of course I did not mean to say there is absolutely no other interference; but in the main that is the great cause of it. There are two things that make that interference—one is the sending of messages and the other is the law itself which requires you to use a certain wave length for sending those messages. Now Government ownership is not going to reduce the number of messages sent; neither is it going to change the law. So that I do not see that we will be any better off, as far as interference is concerned, with Government ownership than we are now; in fact, either under the control of any one company or a Government department.

Mr. SAUNDERS. What you have said on the subject of interference, practically, is derived from your full knowledge of the very large experience that your company has had?

Mr. DAVIS. Yes, sir.

Mr. SAUNDERS. Your company, as I understand, has invested largely and experimented largely in the use of wireless?

Mr. DAVIS. You are quite right.

Mr. SAUNDERS. It is operating now great plants, using a large number of ships equipped with wireless?

Mr. DAVIS. We have something like 25 ships equipped now, and we operate all of them ourselves. We must operate them ourselves, because in the handling of our business we must be in a position to have absolute control of and instant communication with any ship from the time she leaves a United States port until she gets back. And we have that through our own system of stations. Of course it might be said that we can have it through some other system; but if it went through another system we would not have the moral control of the men, which is essential. In other words, we do have certain messages which must go through regardless of static or anything else. And in the Tropics, particularly in the Gulf, during the summer season, where there is the worst static of any place on earth, it is quite frequently necessary for the men to repeat each word in each message from 40 to 50 times in order to get that message through. That is caused in the main by static—atmospheric disturbances. Now, our own men will stick there and get that message through, whereas another man would say, "What is the use." If his job did not depend on getting a certain message through at a certain time, he would not be so keen about it. Our whole organization is built around having a reliable means of quick communication.

Mr. SAUNDERS. In that connection, will you just state briefly, for the record, what static is?

Mr. DAVIS. I do not know whether I am qualified to state just what it is.

Mr. SAUNDERS. I mean as a practical question; I do not mean any abstruse scientific elaboration of it, but just as one practical man would state it to another practical man.

Mr. DAVIS. The static is caused by electrical discharges in the atmosphere, which have the same characteristics, in the main, as the discharges which we use in order to effect wireless communication. And having the same characteristics, it follows that the detectors of the wireless waves must also detect the waves occasioned by this electric disturbance in the atmosphere, which we term "static" or "strays."

Mr. SAUNDERS. In other words, does that amount to this: That nature is making oscillations in the ether of the same wave length as the artificial waves you create through your instruments?

Mr. DAVIS. Practically so; yes, sir; although so far as wave length is concerned, the static will range anywhere from 200 meters to 200,000 meters.

Mr. SAUNDERS. I understand; but the nearer those wave lengths nature is making approach the wave length of the message being sent or received, the greater the disturbance?

Mr. DAVIS. Well, yes and no. The atmospheric disturbances have such an enormous power behind them that it is hard to define or separate them by wave lengths. But for practical purposes it is the same wave length, because unless you get down to 150 meters or less you can not get away from static in the summer time; that is, you can not get entirely away. During the last four or five years the developments have been so great that we can get around a great deal of static; that is, we can eliminate it or force ourselves through by brute force by having enormous power. But there is nothing and probably never will be anything invented to do away with it. The only thing we can hope to do is to overcome it by the development of apparatus which will permit tuning out of the static.

Mr. SAUNDERS. That is, getting your waves away from the length of wave that happens to exist at that particular time in the static? Is that what tuning means?

Mr. DAVIS. By tuning out, I mean the development of receiving apparatus which will respond only to a wave of certain characteristics which will be totally different from those produced by static.

Mr. SAUNDERS. That just means, then, a more delicately responsive receiving instrument—more selective?

Mr. DAVIS. More selective.

Mr. SAUNDERS. A more selective receiving instrument?

Mr. DAVIS. Yes, sir; you are quite right. That same instrument will also go a long ways toward solving our interference problems.

The CHAIRMAN. Let me see if I understand your attitude. You say you are opposed to Government ownership. This bill does not involve, apparently, Government ownership. Are you in favor of the existing law regulating radio communication? If not, what provisions would you suggest should be repealed?

Mr. DAVIS. Well, as I said, the existing law which provides that all ships and all stations in communicating with ships must use the same wave length is, in my opinion, a drawback in the existing law.

The CHAIRMAN. But that is carrying out the provisions of our international convention.

Mr. DAVIS. You are quite right, sir. But the international convention nor the law itself does not keep pace with the development of the art. Of course, it is too late to make the convention flexible now, but in future conventions I think we should bear that in mind and try to make future conventions flexible enough, or use our influence to make future conventions flexible enough, so that regulations can be framed to keep pace with developments in the art. The same thing applies to our own laws. Of course, in enacting the law of 1912 there were a good many things we could not foresee; but that law itself should have been flexible enough so that the Secretary of Commerce, or somebody acting in conjunction with others who were interested, could change the regulations frequently so as to keep pace with the developments as they come out.

The London convention, I believe, or the International radioconvention, is held once every five or seven years. I have forgotten which. Now, during that period we have to abide, of course, strictly by the regulations of the convention; but the convention itself and the regulations of the convention should be such as would permit of the drawing of new regulations to take care of developments both in the art and of the requirements of the service, which are the requirements of the public.

Mr. RODENBERG. What is the date of the last convention?

Mr. DAVIS. London, 1912; I think it was in June.

The CHAIRMAN. You think, then, that regulation of the art by international agreement should not be undertaken at all?

Mr. DAVIS. No—

The CHAIRMAN. Simply because the conventions are not flexible?

Mr. DAVIS. No; I would not say that. It is always desirable to have a complete understanding with all parties who are operating these things; but I think the convention should be as flexible as is consistent—

The CHAIRMAN. To make it flexible, each modification would have to be by agreement, would it not?

Mr. DAVIS. Yes, sir.

The CHAIRMAN. And you could not do that from day to day; it would not be practicable?

Mr. DAVIS. No.

The CHAIRMAN. And hence it must come at stated periods?

Mr. DAVIS. Yes.

The CHAIRMAN. The international convention grew out of confusion in the use of wireless, did it not, because everyone was going his own way and using any wave length he pleased, and there was no uniform rule as to distress signals at sea or as to a time when the Government and commercial parties might have the right of way. All of these matters had become acute, and from the international viewpoint it was thought necessary to make an agreement about them. Is not that true?

Mr. DAVIS. That, I believe, was the idea.

The CHAIRMAN. You do not believe in just repealing all law and having all companies use any wave length they please and do as they please?

Mr. DAVIS. Quite the reverse; I am in favor of regulations which will put everybody in the same boat and which will permit the handling of business without interference, and all that. But I think that these conventions and laws should be flexible, so that each country party to the convention could have a committee to meet once a year and draw up proposed changes and pass on changes submitted, either by a Government bureau or a commercial company; and if after exchanging views with those who have ratified the convention it is found that all are in accord, put the regulations in effect. I think in that way the laws and regulations would be more effective than by enacting a law in 1912 and leaving it until 1917 without leaving a way open which permits taking advantage of the progress of the art.

Mr. SAUNDERS. Is not this the fact, that there are some things which should be very hard and fast; for instance, the distress signals?

Mr. DAVIS. You are quite right.

Mr. SAUNDERS. There are other things where you have a hard and fast rule which may be a wise one with respect to the conditions when established, but in respect to developments that may come in the course of one, two, or three years is a hindrance rather than an improvement.

Mr. DAVIS. You are quite right, except I would not use the word "hindrance."

The CHAIRMAN. I want to get his attitude, whether or not he is in favor of regulation at all.

Mr. DAVIS. I am; yes, sir.

The CHAIRMAN. Very well; then you are in favor of the principle of this bill, but you want it more flexible.

Mr. DAVIS. More flexible; yes, sir.

Mr. RODENBERG. Because of the rapid development of the art.

The CHAIRMAN. I think that is a matter for consideration, of course.

Mr. HARDY. I would like to ask one question. From this gentleman's testimony it looks to me like it was a regular bull-in-a-china-shop convention. Was there any reason at all for requiring or fixing 600 meters as the wave length on which business messages should be sent? As I understand you, the fact that they did require that has caused difficulty and is the main cause of interference now, because all have to go on the same wave length. Was there any reason for prescribing one wave length?

Mr. DAVIS. I do not know that I am perfectly qualified to answer, because I have never had an opportunity to read the minutes of the convention. But it seems to me that one reason for that was that the European nations, which predominated in the convention, or which had the largest representation in the convention, had not progressed as far as America, and through the very fact that their apparatus, and so on, had not been as highly developed as it had in the United States they were forced to adopt that as a means of precaution and, perhaps, protection.

Mr. HARDY. Why were they forced to adopt it, since according to your theory and presentation now there is more interference when they are all traveling on the same track, or on one wave length, than if they had different wave lengths? Why did they adopt the same wave length?

Mr. DAVIS. There was not as much traffic then as now, sir, for one thing. I do not know as I can fully answer the other, because I am not familiar with just what the convention did, although it is my recollection that the American delegation at the convention wanted to give the ships and stations which had occasion to work with ships a wider range of wave lengths than the convention did give them. Perhaps some of the gentlemen who attended the convention can tell you more definitely on that than I can.

Mr. HARDY. You spoke of this business having to be transmitted on a wave length of 300 meters, 600, or 1,800.

Mr. DAVIS. Yes, sir.

Mr. HARDY. Are there no intermediate wave lengths between those three that could be used?

Mr. DAVIS. There are intermediate wave lengths between those three that could be used, but we are not allowed to use them under the law.

Mr. HARDY. You are allowed to use only the specific 300, 600, and 1,800 wave lengths?

Mr. DAVIS. Yes, sir; for handling messages to and from ships. For press bulletins we are permitted to go under 600 meters, but when it comes to handling what is termed general public business we must, under the convention rules use the 600 meters, the 300 or the 1,800 meters. But if a ship wants to use 1,800 meters, for example, she must notify the shore station and the shore station must also shift to 1,800 meters. That involves time and delay, and, in most cases, it probably saves time, rather than to go through all of the difficulties of readjusting the apparatus to the new wave length each time, to wait and send on 600 or else to try to get business off through some other station on 600.

Mr. HARDY. I know we have had quite a lot of testimony about wave lengths reserved to the use of the Government. The purpose of this London convention, in making the requirement that mercantile business be conducted on certain wave lengths was to reserve the other wave lengths for Government uses, was it not?

Mr. DAVIS. That may have been true. My recollection is that some of the commercial people in Europe were represented on the convention, and even they were in favor, at that time, of one wave length.

Mr. HARDY. Can it be made more flexible without giving you some of the part used now by the Navy and other governmental departments?

Mr. DAVIS. No.

Mr. HARDY. In other words, your proposition is to take over for commercial uses, some of the space or field now given over to governmental uses?

Mr. DAVIS. That is what it would involve; yes, sir. For ships, it would probably take from the Government field a range of 300 meters.

Mr. HARDY. So that if you relieve yourselves from interference by reason of broadening the narrow track on which you are now compelled to operate you increase the interference with the Government?

Mr. DAVIS. Not necessarily no sir. Because the development now is toward the higher wave lengths, and the Government is going in for this new development. I refer particularly to the continuous

wave sets, such as the arc. The Government is going in quite strongly, I believe, for that. Now, in those continuous wave transmitters the tendency is to go up in wave lengths, so that the Government, probably after the complete adoption of continuous waves, would have no occasion to go down to six, seven, eight, or nine hundred meters.

Mr. HARDY. Still whatever widening there is of your track must come out of the wide track occupied now by the Government?

Mr. DAVIS. Enlarge the Government's track, if you want to.

Mr. HARDY. Science and art may widen it, but when by law you are given a wider field it must come out of the field now given to the Government.

Mr. DAVIS. Widen the Government's field by law. The commercial station can not use any wave length between 600 and 1,600 meters. If you want to, make that between 750 and 1,750 meters, and the Government is just as well off, I believe, because they still have the same range although in a different scale. That is, instead of working on anything below 1,600 or above 600, they would work on a wave length range from 750 up to 1,750. In other words, you would raise the limits all around.

Mr. HARDY. Now, in order to get a little of the cloud out of my own mind, what is to prevent your commercial messages being sent on a wave length of 250 meters?

Mr. DAVIS. The law itself does not permit it. Besides not being permitted by the law itself, it is not practicable, except in a very few cases.

Mr. HARDY. You must send now on 300 and 600; what is to prevent you sending on 500?

Mr. DAVIS. The law. The law says we must send on 300, 600, or 1,800.

Mr. HARDY. The law limits you precisely to those particular lengths?

Mr. DAVIS. Yes, sir.

Mr. HARDY. And then all these wave lengths between that are reserved to the Government?

Mr. DAVIS. The wave lengths between 600 and 1,600 are reserved to the Government.

Mr. HARDY. But if the Government now does not reserve the wave lengths between 300 and 600, what is the sense of preventing you from using them?

Mr. DAVIS. Because the law says that ships must be tuned to that wave length, and they must use that as the normal working wave length. And then this should be borne in mind, that wave lengths below 500 meters are not practical over fairly long distances. Here is what happened in our case. We have ships going through the Caribbean Sea. Before the London Convention was ratified we used 2-kilowatt sets of a wave length of about 800 meters, which permitted us to radiate a maximum amount of energy from those particular sets. Therefore the antennæ was particularly adapted for that wave length, 800 meters, and we could communicate over a considerable distance through a fairly heavy static. When we had to cut down to 600 meters and also provide for 300 meters, in some cases we had to cut down the antennæ, and in nearly all cases resulted

in reduced radiation—that is, the current radiated from the antennæ—by from 1 to 2 to 3 amperes. That reduced the sending range of the ship.

Now, a ship that does not go within 600 or 700 miles of a shore station during a voyage may want to get in touch with a land station; and, of course, if it is in time of distress they want to create all the disturbance they can in order to attract attention. Now, if we had the apparatus fixed so that we could only use 300 meters or 600 meters, as required by law, some of these times a ship might be in a gale or go high and dry some place, and would want to call for help, and would not be able to bridge the distance. In other words, in order to get the maximum efficiency out of those sets we want to use 750 or something in that neighborhood, when we can send over a greater distance than we can on 600. And we provide for this contingency, however, by providing apparatus which can be changed so as to use longer wave lengths. Of course the convention provides and the law provides that in time of distress a ship can use any wave length she wants to call for help, and that is a very wise provision.

Mr. HARDY. Would it be possible for a hundred different wireless stations all to be tuned to different wave lengths and all get along harmoniously?

Mr. DAVIS. We have always gotten along harmoniously. For instance, where three or four stations are working, we have different wave lengths. We have little troubles at times, but they are all smoothed out.

Mr. HARDY. If that be possible, is there any sense in fixing wave lengths?

Mr. DAVIS. I would not say there should not be some wave length fixed.

Mr. HARDY. Why some, if there is not any danger of interference?

Mr. DAVIS. Because you would not want a ship to have too wide a range.

Mr. HARDY. Why not, if there is no danger of interference, if the wider the track the freer you are from running together?

Mr. DAVIS. In time of distress you want some fixed wave length.

Mr. HARDY. I want to know why. If any fixed wave length increases the difficulty rather than helps it, why would not all fixed wave lengths do the same?

Mr. DAVIS. Well, for distress purposes, there is a provision in the law which says that every 15 minutes a station must listen in on a certain wave length for distress calls. Have that wave length fixed, if you want it, and if the Government wants commercial stations to keep out of certain limits, fix those limits. But do not fix any certain limit for the commercial people to stay on. Then you will reduce the interference. But for distress purposes, we must have a fixed wave length.

Mr. HARDY. What do you mean by fixing the limits for the Government and not fixing the wave length for the commercial interests?

Mr. DAVIS. Fixing the limit between two points, say between 600 and 700, or 600 and 800, and letting the ships handle any work on any wave length between those ranges; or between 500, 600, and 700.

Mr. HARDY. And letting the commercial ships use any other wave length.

Mr. DAVIS. Any wave length in between there.

Mr. GREENE. It seems to me, Mr. Chairman, that we are getting into a pretty wide range here. I am not an expert, and I do not think there is an expert sitting at this table, with all due respect to the questions that have been asked. We are sitting here to try to get information, and we are trying to frame a bill which will hit the high points and the low points and everything else and yet we are not familiar with them at all. Now, we get the opinion of these experts here and they seem to know something about their business; they know what they want. We can take and tie their hands, if we want to, or we can release their hands. It seems to me that the development of the art has shown very clearly, by what has been brought out here, that the world has moved since the international convention in 1912. There has been something happened since that, and in the development of the wireless, too, there is a great change. I can recollect in the early days of the telephone when you could hear everybody talking over the various wires. But now you can put a bunch of wires into a tube and run them through under the water and put them through buildings, and wind around everywhere, and still you can talk without that annoyance. I can not tell you why. But they have been developed, and they are developing this art. And it seems to me they are trying to develop it now, and for us to sit down here and pass on it without a great deal of consideration it seems to me is going it pretty strong.

The CHAIRMAN. I assume that this committee will not pass upon anything without giving it full consideration.

Mr. GREENE. I hope so.

Mr. SAUNDERS. Now, the question of Judge Hardy suggests that if you widen the range which exists for commercial messages you will have to take it out of the Government's range, so to speak. But, as I gather from you, from what you and the other witnesses have said in that connection, so far as the Government is concerned, you simply put them upon other wave lengths without in anywise reducing the Government's efficiency or the Government's field?

Mr. DAVIS. That is right.

Mr. SAUNDERS. It is not a limitation upon the Government in the sense that it is a reduction of the Government's efficiency to put them on this other range or these other waves?

Mr. DAVIS. In fact, I think, it would be quite the other way. I think the Government would prefer working on wave lengths—

Mr. SAUNDERS. As you say, the Government is going in that direction itself by virtue of the use of the continuous wave and the instruments that afford continuous waves?

Mr. DAVIS. Yes, sir.

Mr. SAUNDERS. Now, with respect to these lengths that the London convention decided upon—without undertaking to say what was the reason, in this connection, for confining you to 300, 600, and 1,800—the fact is obvious that the law does confine the commercial messages to those three wave lengths?

Mr. DAVIS. Yes, sir.

Mr. SAUNDERS. And you have pointed out further that in the actual operation of the business, for the reasons given, you have been practically driven down to the one-wave length of 600 meters?

Mr. DAVIS. Yes, sir.

Mr. RODENBERG. I understand there is a gentleman here who attended the London convention, and he can probably tell us how they came to fix those lengths.

The CHAIRMAN. We have a gentleman here who was a member of that conference and when he comes back on the stand perhaps he can enlighten us.

Mr. SAUNDERS. In that connection, I was going to ask this question in respect to what was adopted by the London convention that, having in mind the condition of the art at that time, it may have seemed to them very wise, and may have been so far as the art had progressed, a very wise provision.

Mr. DAVIS. It may have been so at that time.

The CHAIRMAN. It brought order out of chaos; that is what it did.

Mr. SAUNDERS. But the thing has moved since that time, and difficulties that seemed so great then have been so far solved by better knowledge of the principles of the working of the art and better mechanical instruments that it is no longer a wise thing to tie down the commercial people as that convention has tied them down. That, I believe, is the substance of what you have stated?

Mr. DAVIS. That is the substance of what I have said. And I think as the radio develops it will be found that continuous wave will be the ultimate radio equipment. But on continuous waves, with the apparatus we have now, we can not use it effectively on the lower range of wave lengths; we must go to the higher wave lengths. There is now a case of this kind on the Pacific coast. I am not entirely familiar with it, and perhaps the Department of Commerce will have something to say about it; but I believe the Federal Co. had a contract to equip certain ships there with continuous-wave apparatus, and I believe they had a great deal of difficulty in bringing the apparatus used in those ships down to 600 meters. I do not know now whether it is efficient or not, or whether it is effective for the power used as it might be on some other wave length, but it is quite possible, to my mind, that they are losing a great deal of the overhaul efficiency of the set as a whole, because the tendency is toward the higher wave lengths. Now, if we should develop in the next year an exceedingly efficient transmitter suitable for ship work, of a continuous-wave type, it is quite possible it could not be used on 600 meters, then its use on board ship would be prohibited by law, although its actual use on board ship would be a big thing, and in case a ship was 1,000 miles away from any wireless station would probably save the ship in time of distress.

Mr. HARDY. Would not you then have the privilege of using 1,800 meters?

Mr. DAVIS. We would have the privilege of using 1,800 meters; but it is possible with that set it could not be designed so that you could ordinarily work down to 600 and 300; and if it was not you could not get a license from the Department of Commerce, because they are not authorized by law to issue a license to a ship unless it can be attuned to a wave length of 300 and 600 meters long.

Mr. HARDY. Then, if you had this instrument perfected, why not tune it to 1,800 meters, if it could not be tuned down to 300 and 600 meters?

Mr. DAVIS. Because you must be able to tune it to 300 and 600, in accordance with the present act and the London convention.

The CHAIRMAN. We are not speculating now, because we have not an instrument of that kind. Of course, if we had it, it would be wise to modify the international convention.

Mr. HARDY. I understand the use of 1,800 meters is permitted.

The CHAIRMAN. That is what he stated.

Mr. HARDY. Now, he says they can not do that unless they can tune to 300 and 600.

The CHAIRMAN. They can not use it unless they can tune to 300 and 600. The wave lengths between 600 and 1,600 are reserved for the Government.

Mr. HARDY. I understand that. But this new instrument that could be used now, if it could be used on 1,800 meters, I understand Mr. Davis to say could not be used unless it could be tuned to 300 and 600.

Mr. DAVIS. That is the law; that is the very point.

Mr. HARDY. Then, as I understand you, the law does not permit the use of 1,800 meters by an instrument if it can not also be tuned to a 600-meter wave length.

Mr. DAVIS. That is the idea.

Mr. BYRNES. If you will permit me to ask a question. Of course, because of what has gone on in my absence, it is somewhat presumptuous to ask the question. But, as I understand from the questions and answers of those who are in favor of this bill, it was agreed its effect, if not its purpose, was to establish Government ownership; and the question is whether or not that is justified by the military necessities. Now, is this technical discussion for the purpose of showing it is a military necessity, or what is the necessity?

The CHAIRMAN. No; this is just a question to see how far the radio art has developed.

Mr. SAUNDERS. It is to get the necessary body of facts into the record in order to enable us to act on any phase that comes before us.

Mr. HARDY. It seems to me from the testimony that the London convention was a bull in a china shop.

Mr. SAUNDERS. I do not think that is justified from what the witness has stated.

Mr. HARDY. I think it was.

Mr. SAUNDERS. The witness has not said anything of the sort. He said it was all right for that day, but undertook to say that its rules, in view of the development of the art, were no longer applicable.

Mr. HARDY. The witness said the provisions of the law produce more interference now than prevent it, because they are tied down to one wave length.

Mr. SAUNDERS. Yes; by having to stick to that.

Mr. HARDY. Then, I call that a bull in a china shop.

Mr. SAUNDERS. No; that is not a bull in a china shop; that is sticking to a thing that has passed its stage of usefulness.

Mr. HARDY. We won't get into a discussion of what a bull in a china shop is.

Mr. DAVIS. I do think this, that the 600-meter wave length for all ships' business has passed its day of usefulness when you come to prescribing it for all ships and making them stick to it for all of their work. What I think you should have for commercial work is a limit, say, between 600 and 800, and let them select any wave length between 600 and 800 and let them work on that rather than tie them all to one individual wave length and making them stay there. Of course, in the administration of the law by the department, it has allowed a slight variation of, say, 10 per cent or 5 per cent—I have forgotten which.

Mr. HARDY. Now, it seems to me you are getting down to something practicable; you want to enlarge the scope and give them a range between 600 and 800.

Mr. DAVIS. I think that is what ought to be done. Of course it can not be done now.

Mr. HARDY. It can be done by law?

Mr. DAVIS. No, sir; not unless you change the London convention.

Mr. SAUNDERS. That is what I understood you to say all the time, that the London convention just accommodated itself to the development of the art at that particular time, and to add that what seemed to be wise under those conditions experience and the lapse of time has shown you, in respect to these particular wave lengths that are prescribed for commercial purposes, there ought to be a change made in the convention—that you ought to be given a latitude in respect to them, or an enlargement of your limits, rather, in order to more effectively serve modern requirements.

Mr. DAVIS. You are quite right; yes, sir.

Mr. SAUNDERS. It would not have made any difference in those days, because you did not have the instruments to avail yourselves of it; but you state that you now ought to have that latitude because you have advanced to that point where you can take advantage of such a range.

Mr. DAVIS. Yes, sir. Of course, back in 1912, or to go back even farther, where a ship coming into port had only two or three messages, maybe, and in 1912 perhaps had 16, 18, or 20, in 1917 may have increased to 100. And to take care of the traffic they have got to have a number of stations through which the ship can communicate. And they not only have messages to send to the owners of the ships, but they have messages from the public who are demanding from the wireless service a service just as efficient as the land wire service. If a man aboard a ship wants to send a message to New York, to give an order to buy stock or something else, and that message does not go through to destination within a reasonable time, you will hear from it. And the public are dependent upon it just as much as they are dependent upon the wire service.

The following are the amendments suggested by Mr. Davis:

Section 1:

So far as we are aware there has never been a very satisfactory definition of the terms "general" and "limited correspondence," and we therefore suggest that a paragraph be added defining "general public correspondence" and "limited public correspondence," as follows:

"The term 'general public correspondence' as used in this act shall mean all correspondence between ships at sea and coastal stations of any system or administration. The term 'limited public correspondence' as used in this act

shall mean all correspondence between ships at sea and certain coastal or commercial stations designated in the license."

Section 2, paragraph 2:

It is not clear that a ship may hold both a "general public" and a "limited public" correspondence license, and as it will often occur that a ship holding a "limited public" license which restricts its communication to stations named in the license would be diverted to another port there should be nothing in the law which would prevent that ship from communicating with any station it saw fit, and we believe that it should therefore be made perfectly clear in this act that a ship may hold a license of either and both classes, and it is therefore suggested that a sentence be added reading as follows:

"But nothing in this act shall be construed as prohibiting a ship from applying for and receiving a license for both general and limited public correspondence."

Section 2, paragraph 3:

Could be interpreted as closing our New Orleans station to the handling of messages between fixed points whose ultimate destinations are ships at sea, as well as to prevent the handling of messages direct with United Fruit Co. ships. The handling of messages between New Orleans and ships at sea via Swan Island, for example, is of great importance to merchant ships in general, as it is their only means of communication when in the Caribbean Sea and the southern part of the Gulf of Mexico, and this paragraph should therefore, in our opinion, make provision for the handling of this class of traffic; that is to say, permit the handling of messages to and from ships direct, as well as the handling of messages between fixed points whose ultimate destinations are ships at sea and which can only be reached by this method of handling—relaying—and the handling of all classes of messages for the general public to and from Central American points via one or more relay points. It seems that this contingency can be taken care of by adding a sentence to paragraph 3, section 2, reading as follows:

"But nothing contained in this act shall be construed as preventing the issuance of a license of either one and all classes to a commercial station for the handling of all classes of correspondence."

Section 5, paragraph 1:

It is not quite clear whether this provision is meant to apply only to correspondence between coastal stations and ships at sea, and it might also act to prevent a reduction in rates to meet competition. It is suggested that this be made clear, as follows:

"The rates charged on all correspondence to and from ships at sea by all licensed stations shall be stated in the licenses, and shall not exceed those determined by the London Radio Telegraph Convention of 1912 or other international radiotelegraphic conventions to which the United States is signatory."

Section 9, paragraph 3:

As a practical matter it would be impossible for the Secretary of Commerce to regulate the total rate to be charged when foreign connecting stations are concerned in the transmission of messages, and it seems unfair to radio companies that their rates be regulated when the rates of their competitors, which are the cable companies, are not. It is submitted that competition between radio and cable companies would properly take care of the rate question, and it is therefore suggested that this paragraph be changed to read as follows:

"Rates to be charged shall be as specified in the license."

Section 9, paragraph 6:

It will often occur that on account of accident, atmospheric or other conditions a station can not operate at hours specified in the license, or that it is advisable to work at hours other than those specified in the license. It is suggested that this paragraph be amended to read as follows:

"Decrement authorized for use by the station and the hours at which the station is ordinarily supposed to be in position to send or receive messages, but nothing herein shall prevent such station from working at hours other than those specified in the license, and no penalty is to be attached for failure to work at the hours specified in the license, due to emergency or other conditions which could not be foreseen when the license application was filed."

Section 10:

As minor violations of the act might be unintentional or might be wilfully made by dissatisfied employees, without the knowledge or approval of the radio company, and although the Secretary of Commerce, in arriving at a decision

in the matter, would without doubt take such circumstances into consideration, it is nevertheless thought that this section should be amended so as to make this point clear. It is suggested that this be amended as follows:

"Any station license may be revoked by the Secretary of Commerce for wilfull or intentional violation of or failure to observe any of the restrictions or conditions mentioned in the preceding section or other provision of this act."

Section 16, paragraph 2:

As this is a provision of the London convention which is admittedly not conducive to the proper handling of radio traffic, and does not effectually serve the purpose for which it was included in the convention, it is believed that it should be stricken from this act entirely, so that there will be no interference with any new regulation which the next international radiotelegraphic convention might deem necessary in this respect. The fact that it is already a part of the London convention makes it a law of the land, and nothing would be lost by omitting it from the proposed act. Or, if this suggestion is not entirely feasible, amend the paragraph to read as follows:

"Every coastal station whose operation interferes, or would interfere, with the exchange of messages between ship and ship or ship and coast is required to listen in at such intervals and on such wave lengths as are specified in the London convention of 1912 or as may be required by future international radiotelegraphic conventions: *Provided, however,* That the Secretary of Commerce may waive this requirement with respect to certain stations at his discretion."

Section 17, paragraph 2:

It is highly desirable that the limit of the logarithmic decrement be specified as was done in the act of August 13, 1912, and that this limit be fixed in such a manner as will not operate to prevent the renewal of licenses of stations in operation at the time of passage of this act. For future installations it is suggested that a reasonable decrement for a quenched spark set of good design be determined and this fixed as the limit and specified in the act.

Section 17, paragraph 3:

In its present form this paragraph might be construed to permit the Department of Commerce to condemn receiving apparatus as unserviceable when, to use any other would infringe the patent rights held by another company, with consequent suits for damages, and it is therefore suggested that this be changed to read as follows:

"Receiving apparatus should preferably be of such construction and be so adjusted and used as to give the greatest practicable protection against interference."

Section 20, paragraph 2:

As one object of the act is to reduce interference, and as continuous wave transmitters are a development along this line, it is not believed that there should be anything in the act which would prevent the development and commercial use of small continuous wave sets on wave lengths of less than 4,000 meters, and, in our opinion, this paragraph should be stricken out altogether or amended in such a way that it will be possible to install and operate small powered sets; for example, by reducing the limit to 1,800 meters.

Section 20, paragraph 3:

In certain cases our New Orleans station, for example, where communication with ships at sea not within direct range can only be held through the medium of a relaying station, such as Swan Island; and as such communications are obviously of equal importance to ships at sea as those which are affected by direct communication, this paragraph should be amended to read:

"Preference shall be given to stations handling ship communication, either direct or by means of relaying stations, or between points, where other means of communication are not available."

Section 21:

In order to provide for special service with certain stations from ships at sea it is desirable that they use wave lengths other than those specified, and it is suggested that lines 1 to 10, inclusive, on page 21, be stricken out and a clause added as follows:

"Such stations may also use such additional wave lengths as may be permitted by the Secretary of Commerce."

Section 24:

It seems to us that at points where there are one or more stations which are required to observe division of time it would be more equitable to divide

the time equally among all the stations concerned; but in any event we think that there should be a clause added to this section, reading as follows:

"But nothing in this act shall be construed as preventing the Government and commercial stations making mutual arrangements as to the division of time."

STATEMENT OF MR. LEE DE FOREST, OF NEW YORK, N. Y., RADIO ENGINEER AND PRESIDENT OF THE DE FOREST RADIO TELEPHONE AND TELEGRAPH CO.

The CHAIRMAN. Please give the committee your name and business.

Mr. DE FOREST. Lee De Forest, radioengineer, New York City.

The CHAIRMAN. Are you connected with any of these commercial companies in a financial way?

Mr. DE FOREST. I am president of the De Forest Radio Telephone and Telegraph Co., which is strictly a manufacturing company, manufacturing telephone and telegraph apparatus, largely at the present time for the United States Government.

The CHAIRMAN. Are you connected financially with any other companies?

Mr. DE FOREST. No, sir; in no way.

The CHAIRMAN. How long have you been a student of this art, and an inventor?

Mr. DE FOREST. Since 1900. I have devoted my energies exclusively to wireless practically from its beginning in this country.

The general purpose of the bill now before you is excellent—to safeguard the Nation's interests in time of war and to diminish the existing interference between radio stations. As a first step toward this latter object, the proposed purchase by the Government of all coastal stations for ship communication is commendable and meets with our hearty approval. We believe that this step will result in better and cheaper radio service to shipowners.

In certain respects, however, this bill is shortsighted. It omits due provision to permit and foster the development of radiotelephony, an infant art but one which is destined to enjoy equal, nay more, wide application than radiotelegraphy. Certain provisions of this act would, if applied by the Secretary of Commerce in a strict and rigorous manner, most seriously handicap the development of an art which can be made of great public utility and convenience, utility not only to vessel owners but to thousands inland. I am referring now to wireless telephone.

To be specific, a large class of smaller vessels during the next few years can, and will, unless this law prevents, utilize the radiotelephone—a class of vessels where it is impracticable, on account of the expense involved, to maintain among their crew skilled Morse operators. If the skipper or mate of such a vessel know merely enough of the Morse code to read a warning call or a request to "keep out," that he is interfering with other telegraphic communication, he should be, we claim, licensed to use the radiotelephone under certain restrictions of power and wave length. Experts will agree that the tuning out of the radiotelephone is far easier than with any spark type of telegraph; and there is no good reason why full leeway for the application of so great a convenience to commerce as the radiophone should not be specifically provided for in this bill.

The application of radiotelephony was scarcely thought of at the date of the London convention, but in view of the startling developments of this new art during the past two years, there is no reason why the Secretary of Commerce should not be specifically empowered to grant special licenses now to vessels which desire to use this new convenience. This authority, we claim, should be broad in scope, and applied in the liberal spirit which has generally characterized the attitude of our Government toward new and useful inventions.

For example, inasmuch as radiotelephony with undamped waves operates best on small ship stations, at 800 to 1,000 meters, we urge that the Secretary of Commerce be empowered in this proposed act to grant licenses to vessels to operate under proper restrictions radiotelephone transmitters on such wave lengths. Section 19 of this bill does give the Secretary power to grant "special temporary licenses," but this or some other section should specifically encourage such action on his part for radiotelephone stations. No harm, but on the contrary very great benefit to vessel owners, will result from such recognition in this proposed act of this new development in sea signaling. With the Government reserving for itself so broad and convenient a zone of wave lengths as from 600 to 4,000 meters, it can very well afford to be so farsighted and generous to the new art of radiotelephony as to allot to it a range of from 800 to 1,000 meters.

It is no exaggeration to state that during the next five years thousands of vessels which are not compelled by law to carry the radiotelegraph and Morse operators, will gladly equip themselves with the telephone simply for the sake of being able to cry out for help in danger, if for no other purposes of commerce and convenience. Do not, gentlemen, we earnestly appeal, commit the grave error of failing now to recognize and justly encourage this great future utility. So much for radiotelephony on shipboard.

Now, as regards the recommendations which have been made before this committee that the Government now decide to purchase not only all existing coastal stations, but all commercial radio stations, we beg to point out that as to transcontinental and transoceanic commercial radio stations, there is absolutely no more reason why these telegraph or submarine cables should be governmentally owned. The art of long-distance radio communication is to-day very much where the ocean cable was after the first Atlantic cable was laid. Will anyone say that the art of cable telegraphy or the transcontinental telephone (a model to all the world of American inventive and engineering skill) would be where they are to-day, had any Government owned these and undertaken their development? The answer is unquestionably and undeniably no. The same reasons emphatically hold good to-day as regards long-distance commercial radio signals. Nowhere in the history of invention has such highly technical and commercial problems as are here involved been worked out under Government ownership.

Not the slightest reflection against the ability, zeal, or integrity of Government experts is here intended; but from the very nature of things this has been so and will continue to be so. And this radio art can, if not now palsied by premature Government ownership, develop to become a most serious competitor to the ocean cable and transcontinental telegraph. In fact, transoceanic telephony can never be realized except by the radio telephone.

In summation: Long-distance radio communication, telephone as well as telegraph, welcomes wise and friendly Government regulation. But Government ownership during this present developmental period would mean stagnation and irrevocably retard what should become a utility of enormous value.

I presume that the question of radiotelephony has not been brought up before this committee by any other witness; at least, I have not so heard.

The CHAIRMAN. No; it has not been discussed.

Mr. DE FOREST. I think that, particularly now as we recognize the shortsightedness of some of the provisions of the London convention and the rigorousness with which those old regulations apply to an art which has outgrown them, they should be a warning to the committee not to commit a like error at this time in farming this bill and not to frame it without a provision for radiotelephony. Because it is a moral certainty that before another bill is brought to the attention of Congress, providing this is passed, the art of radiotelephony will have so progressed that unless this bill makes provision for it it will be very seriously handicapped, and its public utility will be correspondingly repressed. I am sure no one here wishes to see that situation.

The CHAIRMAN. How far has it developed in efficiency?

Mr. DE FOREST. In operation it is possible now to telephone with the clearness of the wire over a distance of from 50 to 400 miles, using very much smaller power than has hitherto been necessary to telegraph that same distance with the spark telegraph. I am not comparing undamped wave telephony with undamped wave telegraphy, but comparing undamped wave telephony, which is the only radiotelephony, with the spark telegraph.

Mr. SAUNDERS. What do you call undamped wave; is that the continuous wave?

Mr. DE FOREST. That is the continuous wave.

Mr. SAUNDERS. The spark wave is what you call the damped wave?

Mr. DE FOREST. The damped wave; yes, sir. The damped wave is impracticable to be used in a telephone transmitter. In radiotelephony we must, in order to get clear speech, use undamped continuous radiation. The wireless-telephone transmitter is now a genuinely practical device. I think experts of other companies than my own will bear me out in that. The transmitter is on the line of an incandescent lamp. It is as regular as the operation of an incandescent lamp and as easy to operate, simply by throwing on a switch and talking into a microphone. That is all there is to it. The receiver is the same as the wireless-telegraph receiver, so that any ship equipped with a wireless-telegraph receiver can receive from the telephone. In fact, at the present time there are thousands of telegraph receivers within a radius of 100 miles of New York which are hearing nightly radiotelephone messages sent out from my laboratory. So that hundreds of the small vessels where the wireless telegraph is not now compelled by law to be installed and where the expense of a Morse operator in their crew is prohibitive will welcome the wireless telephone as a means of commercial utility and for calling out for help in time of danger. It means practically no additional expense to them for the initial cost of the apparatus.

In the few instances that have thus far come before the Secretary of Commerce for a license for a wireless telephone operator on a ship he has very generously ruled that an operator who is capable of receiving five words a minute Morse could be licensed to act as a wireless telephone operator; so that he could receive and make out warning signals or signals of danger—S O S calls—and the request to keep out, the signal for interference, if he was interfering with telegraphic communication. Those requirements are very, very different from the requirements prescribed for a Morse operator, and almost any officer of the ship, the skipper, mate, or engineer, can in a few weeks' practice learn sufficient Morse to qualify in that respect, and then be abundantly able to handle the wireless telephone apparatus on a ship. But I think that unless some due provision or recognition of that situation is made in this act it might be that the Secretary of Commerce would feel, in some future cases, where applications came in in enormous numbers, that he would be compelled to stick to a rigorous interpretation of the law as regards telegraph operators, which would amount to the taking away of the advantages which the wireless telephone would confer. The shipowner, in that case, might just as well have a wireless telegraph outfit, because he would have to maintain the expensive Morse operator in his crew.

The CHAIRMAN. You think it ought to provide for the permissive use of the wireless telephone and then define the qualifications of the operator?

Mr. DE FOREST. Yes; limit those qualifications as Commissioner Chamberlain has in one or two cases where we put in a wireless telephone on a yacht and applied for a license. It was entirely informal and optional on his part in holding that a Morse operator who was capable of receiving five words a minute could be licensed.

Mr. HARDY. As I understand, in that case it was held sufficient training to be able to interpret signals to keep out?

Mr. DE FOREST. Yes.

Mr. HARDY. The necessary signals to keep from interfering when it would be necessary for him to do so?

Mr. DE FOREST. Yes. The SOS signal, of course, is very easy to learn. It requires some training, but that is no hardship on any vessel owner to find some member of his crew who could qualify to that extent.

Mr. HARDY. You think that is easy to be met?

Mr. DE FOREST. Yes; I think that is a wise provision. I think that ought to be in the bill, because if they had no knowledge of Morse they would be talking away blithely indifferent to interference with any telegraphic call.

Mr. HARDY. In effect, the desired amendment to this bill would simply be to relieve these small vessels of the expense of carrying a regular operator?

Mr. DE FOREST. Yes. At the present time the law does not compel certain classes of vessels to carry Morse wireless operators, and it is not enough advantage to them to warrant them installing on the ship a wireless telegraph set, in which case they must comply with the regulations of having a licensed wireless operator.

Mr. HARDY. Under the law now the vessel that is not required to put on wireless, would it not be permitted, nevertheless, to put on the wireless and use this unskilled operator you are talking about?

Mr. DE FOREST. I think not. If they put on the wireless, they must have in charge a man who has passed the regular examination.

Mr. HARDY. That is what I want to know, whether if they did do it they would be required to carry a licensed wireless operator.

Mr. DE FOREST. I am quite certain that is the case, that if they put on the wireless they must have in charge a skilled Morse wireless man.

Mr. HARDY. And that is the amendment you want in this bill, that if they are not required to put on wireless, but do it, they may use a less skilled man?

Mr. DE FOREST. If they put on the wireless telephone, that they can use the less skilled man.

Mr. HARDY. Is the wireless telephone a different instrument, or is it a wireless telegraph instrument which they use?

Mr. DE FOREST. It can be used very easily as a telegraph instrument by connecting the Morse key into the circuit. It is practically nothing to change a radiotelephone to a telegraph instrument; but unless a Morse operator is in the crew who has obtained the necessary license this key adjunct would not be put on; so that it would not be possible for an unskilled man to begin to telegraph with the apparatus. He must use it as a telephone, for which it was intended primarily.

The CHAIRMAN. All the signals that go out, the messages for the shore stations, go in the Morse code?

Mr. DE FOREST. Yes.

The CHAIRMAN. And hence the operator on shipboard must understand the code in order to be efficient.

Mr. DE FOREST. To a certain extent; yes, sir. But unless he is going to maintain commercial communication with this Morse station on shore, it is not necessary that he should be skilled in the Morse code.

The CHAIRMAN. In talking from the ship to the shore, of course you do not use any code at all?

Mr. DE FOREST. Just the voice, provided, of course, the shore station has a telephone as well as the telegraph, which is something we look forward to at the Government Station.

The CHAIRMAN. You said you thought the provisions in this bill, that the Government might take over the shore stations, were all right, and met with your approval?

Mr. DE FOREST. Yes; we approve of that provision as far as coastal stations for operating the ships go. We make a distinction between those stations and long distance shore-to-shore stations—for example, from our eastern coast to Europe, or from our western coast to Japan; or, the illustration given by Mr. Davis, from New Orleans to Costa Rica. We believe there is a genuine fundamental distinction between those two classes. I should like very much to see the Government control and own all of the coastal stations. I believe it would encourage vessel owners to a wider use of the wireless and would be a general convenience and important in the safety of travelers at sea. But I should dislike very much to see the Government own the long-distance commercial stations, because at this stage of the art such a vast number of intricate problems have still to be worked out before those stations are perfected, I believe that with the best intentions in the world the Government

can not solve those problems as well as commercial companies whose financial success depends absolutely on solving those problems as speedily and quickly as possible.

Mr. HARDY. In reference to the long-distance stations—inland, or from continent to continent—you want them owned by commercial companies?

Mr. DE FOREST. Yes, sir. I think they should be owned by commercial companies, with all the logic that would apply to companies owning either the transcontinental telegraph or telephone lines. I firmly believe that it is only a short period of time before we will see commercial wireless telephony between this country and Europe; but I am convinced it would be a long time before the Government would feel justified in appropriating the large sums of money necessary to build the stations and to hire the experts to develop that art. I believe that transcontinental wireless telephony will be of the utmost utility in commerce, but if the Government should now own outright all transoceanic stations, it would palsy the efforts of commercial companies which may, in the next few years, attempt that task.

Mr. HARDY. What you approve, then, is the Government owning the ship-to-shore service?

Mr. DE FOREST. Yes; I heartily approve of that. I believe that will eliminate, to a large extent, the interference and, more than that, will encourage vessel owners to get up-to-date wireless equipment for their ships and more vessels will equip than are now using the wireless.

Mr. HARDY. So that in order to eliminate interference you are inclined to think there must be a unity of ownership of these ship-to-shore stations, and you prefer that to be in the Government rather than in a big private monopoly; is that the idea?

Mr. DE FOREST. Yes. And right in that connection, I believe that the ban which now compels all vessels to work on 600 meters or 300 meters should be lifted; that they should be given a wider zone, and that, of course, goes hand in hand with the Government ownership of coastal stations. If the Government owned those coastal stations, there is no reason why they should not operate on 500 to 800 meters with the ships—with any ship that calls them.

The CHAIRMAN. To what extent has interference with the ships been overcome by the development of the art?

Mr. DE FOREST. To the greatest extent in the last two years. The greatest step to overcome that interference has been the development of the undamped wave in the transmitter with the great refinements that makes possible at the receiving station. And I believe, without exception, that in five years every transmitting station, telephone as well as telegraph, will use the undamped wave and that that in itself will enormously simplify the interference problem. But to-day, even if the ships and stations did use the undamped wave transmitters, it would be impossible without refinements in the receivers for them to operate. Of course, it is obvious therefore we must have zones for certain calls and my experience leads me to suggest 500 to 800 meters for ships of that size. And in that zone, with undamped transmitters on ships it would be possible, I believe, to carry on all the communication necessary without interference.

There might be times when a ship would have to wait its turn, but delays on that account would be comparatively nothing to what they are to-day.

Mr. ROWE. What effect on the Government's neutrality will the operation of wireless telephony have?

Mr. DE FOREST. I can not see it would have any bearing, because the legitimate field of the wireless telephone on shipboard is for a comparatively short distance—say, 400 miles at the outside. There would be no question of ships operating to foreign countries with the wireless telephone, if I get your meaning.

Mr. ROWE. I was thinking more especially of talking from one point in this Government to another Government with the wireless telephone. Would it have any effect?

Mr. DE FOREST. It might conceivably have the same effect as the wireless telegraph. For instance, a station on this coast working with one in Europe might violate the neutrality law, just the same as the telegraph could; but that could be prevented by censorship, the same as the telegraph stations are now censored.

Mr. BYRNES. Do you think the wireless telegraph neutrality violations would be eliminated by censorship, then?

Mr. DE FOREST. I see no reason why they could not, just as well as violations of neutrality by cable. I can not see why the conditions obtaining in one should not equally obtain in the other.

The CHAIRMAN. As I understand, the basis for your argument is that there is no real necessity for Government ownership and control of the wireless commercial lines communicating, for instance, from this country to Europe or from this country to Japan any more than would apply to the control of the cable itself?

Mr. DE FOREST. No; I can see no genuine distinction.

The CHAIRMAN. If the argument is good, they must take over the cable as well as the wireless?

Mr. DE FOREST. Exactly.

Mr. BYRNES. And it is likewise good for the telephone?

Mr. DE FOREST. Exactly. I do not see any reason why the wireless, outside of the military and naval aspects, should be subjected to Government ownership any more than any other means of communication.

The CHAIRMAN. From the naval or military viewpoint, might not these high-power stations be controlled by the Government, and should they not be controlled in the event of war or great public calamity?

Mr. DE FOREST. By all means; most certainly. In those times and in the times of threatened peril, the Government should and undoubtedly would, be empowered to step in and take charge of the complete operation of the stations. The idea is we would always welcome Government supervision and regulation as distinguished from Government ownership.

Mr. HARDY. Dr. De Forest, it seems to me there is one distinction or difference between the cable and telegraph and this wireless business: The cable has its point of destination well known, as well as the point of initiation of messages, and you can censor them somewhat with a view to where the message is going. But your wireless could send to a ship out in mid-ocean, which might relay the message.

In fact, while the location of the wireless station on shore is known, the location of the receiving station is absolutely unknown.

Mr. DE FOREST. That is true.

Mr. HARDY. Does not that make a considerable difference in the principles that would apply to the control of those two means of communication?

Mr. DE FOREST. But you can control either one at the transmitter, can you not?

Mr. HARDY. You can control them at the transmitter; yes; but any kind of an apparently harmless message might go to a ship in mid-ocean that had some secret, private code and be transmitted elsewhere. And it seems to me the difficulty of absolutely doing anything effective would be greatly enhanced by that difference between the two mediums of exchange.

Mr. DE FOREST. But how does that situation differ from the case where our country is connected by cable to a more or less hostile country, although hostilities have not yet broken out. We send a censored message which is apparently perfectly innocent and harmless. We have no means of controlling the interpretation of that message on the receipt of that message at the other end, the other end being in a foreign country, any more than we can control the receipt of a wireless message on a ship at sea.

Mr. HARDY. That is true so far; but in case of the breaking out of hostilities with some foreign country we could cut off all communication except such as the Government itself sent by cable; but it could not effectively close up wireless stations and say they could send no more messages to ships at sea, because of the difficulty of enforcing, whereas you could close your cables down and have no communication to the foreign country.

Mr. DE FOREST. If there was any possible doubt as to the meaning of a message being sent by wireless, of course the Government could give itself the benefit of the doubt and suppress the message entirely.

Mr. HARDY. Yes; if you had any doubt. I just suggest that as a possible distinction.

Mr. SAUNDERS. Doctor, let us take that up a little, this latter suggestion, and see if it presents any real difficulty. If that difficulty really exists, how is Government ownership going to stop it? If he has presented a problem there, how is Government ownership going to solve it?

Mr. DE FOREST. I do not see how Government ownership will relieve the situation, except they just absolutely refuse to take any messages other than their own, and they could do that in any case.

Mr. SAUNDERS. I was about to say they could stop any messages being sent to sea at all.

Mr. DE FOREST. Yes.

Mr. SAUNDERS. And if any innocent message can be sent out and resolved in the way you speak of, then an innocent message could be sent out just as well if the Government owned the wireless as if the Government did not own the wireless.

Mr. DE FOREST. Quite true.

Mr. SAUNDERS. Then, following the suggestion of a message being sent to a ship at sea and being relayed by the ship, is not that perfectly possible by the cable? We could send a perfectly innocent

message to-morrow from this country to some other country—to Cuba or South America—and it could then be relayed from there?

Mr. DE FOREST. It certainly could.

Mr. SAUNDERS. If that makes a difficulty, the same sort of difficulty exists in respect to the cable, and it just brings us back to this situation, that in order to meet the suggested difficulty you would simply have to stop on the part of the transmission station the sending out of any messages at all, except messages that the Government sends out for itself.

Mr. DE FOREST. Yes; it seems to me that the ends desired could be accomplished by a strict Government control of the transmitter in any case.

Mr. SAUNDERS. And if that is the only solution of it and if there is any other solution it ought to be developed in this connection, then the Government control over the sending would secure exactly the same results as Government ownership of the sending instruments?

Mr. DE FOREST. Exactly. If the Government owned the stations and they were open at all to public messages, the most harmless-appearing message could be filed and get across just as readily as if it were a privately owned station and there was a Government censor placed in charge.

Mr. SAUNDERS. I want to ask you another question in regard to what some of the other witnesses have developed: The art has been considerably developed since the London convention in its knowledge of what interference is.

Mr. DE FOREST. There have been a great many new theories propounded since 1912 as to the various causes of these strays and atmospheric disturbances; but the scientists to-day are still somewhat at sea as to the ultimate causes.

Mr. SAUNDERS. That is just what I want to bring out—as to what interference is there that they are still at sea about in the field of wireless telegraphy.

Mr. DE FOREST. Of course, there are two classes of interference—natural atmospheric interference and interference from other transmitting stations—which must be distinguished.

Mr. SAUNDERS. I am referring to interference from static, not artificial, interference; as to how it is done and as to what it is. Maybe I do not make myself clear, and I will change the question a little. Some of the witnesses who preceded you have stated to us that, practically, interference is other messages in the air at the same time, all of the same wave length, and not of different wave lengths. Do you agree to that statement—that interference chiefly consists in competing messages, so to speak, of the same wave length as the message you are seeking to intercept?

Mr. DE FOREST. No; my understanding is that the atmospheric disturbance could hardly be said to have wave lengths at all. They are just splashes of enormous power, single impulses in the atmosphere, which are let loose by some lightning discharge or electrical discharge somewhere in the upper atmosphere or the lower clouds, and that electrical etheric splash travels in all directions, and it is of such power that when it strikes the antennæ, no matter what the tuning of the antennæ is, it will set in vibration all the strings in connection with the antennæ, just the same as taking a piano and striking a blow on the keys with the dampener off the strings, and every string in that piano will respond.

Mr. SAUNDERS. That is static?

Mr. DE FOREST. That is static.

Mr. SAUNDERS. Suppose I suggest a deliberate case of interference: I asked some of the witnesses who preceded you somewhat the same question. Would I simply set in motion a violent disturbance in the ether, without regard to the length of the waves, or would I send out a message having a wave length the same as the message that I wanted to interfere with?

Mr. DE FOREST. With which you are deliberately seeking to interfere?

Mr. SAUNDERS. I am deliberately seeking to make interference.

Mr. DE FOREST. If you know the wave length the other party is using with which you wish to interfere, it is much more effective to send out a wave which has the strength and determined characteristics of that particular wave length. If you do not know what he is using, but just want to interfere at random, the proper thing to do is to use a splash or spark which resembles the atmospheric splash as large as you can.

Mr. SAUNDERS. That agrees, then, with what the other witnesses have said, that the best way to artificially create disturbance or interference is to use a wave of the same length as the wave of the message you want to interrupt or interfere with?

Mr. DE FOREST. Yes; by all means.

Mr. SAUNDERS. And you can do that more readily than you can assimilate a static interference?

Mr. DE FOREST. Yes.

Mr. SAUNDERS. Because you can not get the same power artificially as is behind a static interference.

Mr. DE FOREST. The static interference may be caused by an amount of energy represented by thousands, perhaps hundreds of thousands, of horsepower, and it would be impossible for any station to produce any such artificial condition.

Mr. SAUNDERS. Let me ask you another question: Then, in the present condition of the art, the real problem is the interference of static?

Mr. DE FOREST. That, I think, is the most serious problem.

Mr. SAUNDERS. Is that the most serious side of it?

Mr. DE FOREST. Yes, sir.

Mr. SAUNDERS. Now, then, that is something that can not be controlled by regulation, can it?

Mr. DE FOREST. No.

Mr. SAUNDERS. It has got to be bridged through the development of the skill of the wireless operator and sensitiveness and delicacy of the instruments used?

Mr. DE FOREST. Yes, sir; and the more the receiving instrument is refined, the nearer we come to that by the elimination of static interference. I do not wish to state that it will ever be completely eliminated, but as an incentive to the development of refinements in the receiving apparatus nothing is better calculated than that the transmissions should be of a variety of wave lengths and not on one wave length. I think the history of the art proves that. On ships when they are operating, the only wave lengths on which they can receive messages are 300 and 600 meters, and the receiving instruments have become very crude; they have not developed at all. On the other

hand, where the receiver is designed to pick out a great variety of wave lengths and to keep out interference from a great variety of wave lengths, you will find that receiver is far in advance in design and selectivity over one of the other sort. So that I feel the two problems go hand in hand—allowing the transmitters a reasonable range of wave lengths within certain restricted zones and the developing of receivers which can pick out the desired wave length within that zone, and, at the same time, those receivers that can cut out static to a certain extent.

Mr. SAUNDERS. And you agree with the witness who preceded you if you give that flexibility of use in respect to sea signaling that that does not in anywise interfere with the Government's field, as it is using the higher wave lengths?

Mr. DE FOREST. No, sir. For instance, if we had a ship's zone of wave lengths of from 500 to 800 meters, and then give the Government a range of from 800 to 1,800; then give the larger ships a range of 1,800 to 2,000; then give the Government another zone of 2,000 to 4,000, or to 3,000—that arrangement would be far more flexible and wholly practicable.

Mr. SAUNDERS. So you can make a definitely better arrangement for sea signaling without at all diminishing the Government's field?

Mr. DE FOREST. Oh, yes.

Mr. SAUNDERS. Or interfering with the necessities, so to speak, of the Government.

Mr. DE FOREST. Exactly. I do not think the Government service would suffer at all if the present wave range proposed in this bill of 600 to 4,000 meters were sliced in the middle, and perhaps a slice taken out of it and reserved for commercial communication. I think this could be narrowed.

The CHAIRMAN. But you do think, as I understand, that certain limitations should be placed on the commercial use of the wave lengths and the governmental use?

Mr. DE FOREST. Exactly.

The CHAIRMAN. You think the wave lengths, however, as provided in the international convention, should be readjusted?

Mr. DE FOREST. Yes; I think the art has advanced to such a state the demand for communication is so great it demands that readjustment.

The CHAIRMAN. Do you think we would be justified in renouncing the international convention or awaiting such time as those wave lengths could be readjusted by international agreement?

Mr. DE FOREST. In view of the uncertainty of the termination of the present war in Europe, I think it would be most unwise to wait. It certainly is impracticable to set a date for revising the international convention now.

The CHAIRMAN. But we can not do so now unless we do renounce that convention.

Mr. DE FOREST. I am heartily in favor of renouncing that convention on the part of the United States. I think it is becoming more and more, month by month, a handicap on our progress and our commercial communication at sea.

The CHAIRMAN. What effect would it have on safety of life at sea? Because, after all, that is the greatest use to which the wire-

less has been put so far. (See pp. 417-430, showing where wireless has been a safeguard to life at sea.)

Mr. DE FOREST. By all means. I would still retain that calls for help should be sent out primarily on 600 meters and reserve that very narrow range there, say of 50 meters, for calls for help. As I understand now, the ship in distress can use any wave length they are able to use. The antennæ may be swept away and the ship have to put up a new antennæ, or something in a hurry, and it can use any wave length that is possible. Therefore the force of that regulation is more or less upset by those conditions. But I think if we had one fixed wave length for distress signals and then divided the remainder up into zones for the Government and ship stations, everyone would be better pleased and the development of the art would be greatly enhanced.

The CHAIRMAN. Is there anyone else who wishes to be heard?

**STATEMENT OF MR. FRITZ LOWENSTEIN, OF BROOKLYN, N. Y.,
MANUFACTURER OF RADIO APPARATUS AND CONTRACTOR
WITH THE UNITED STATES GOVERNMENT.**

The CHAIRMAN. Tell us who you are and what interests you represent, if any.

Mr. LOWENSTEIN. I am a manufacturer of radio apparatus and contractor with the United States Government—with the Army and Navy Departments.

The CHAIRMAN. Where are you located?

Mr. LOWENSTEIN. I am located at Brooklyn.

The CHAIRMAN. And what is the name of your firm?

Mr. LOWENSTEIN. Fritz Lowenstein, consulting engineer.

The CHAIRMAN. It is a private business?

Mr. LOWENSTEIN. It is.

Mr. GREENE. Do you do any business outside of the Government?

Mr. LOWENSTEIN. I do not, sir.

Mr. GREENE. Only for the Army and Navy?

Mr. LOWENSTEIN. Very little outside.

The CHAIRMAN. Proceed.

Mr. LOWENSTEIN. If I may give a short history of my connection with the art, I am a graduate of the University of Vienna and have since worked under Baltzman and Baker in Paris, and at postgraduate work, having taken up the work in radio in 1899. At that time I helped to design and erect and operate a station of 60 kilowatts, which for many years has not been equaled. So I consider, I presume, that I am one of the pioneers in this room now.

The CHAIRMAN. Where is that station located?

Mr. LOWENSTEIN. That station is located at Colorado Springs, Colo. I have subsequently been connected with the Radio Telephone Co. as consulting engineer to the president in 1909; and upon the conclusion of that engagement took up the manufacture of apparatus for the Government and myself. I have since then been elected as president and vice president of the two scientific institutions, the Society of Wireless Telegraph Engineers, and the Institute of Radio Engineers.

I have furnished a great number of sets and equipments for the United States Navy, and also for the Army. I wish to make a few

remarks relating, first of all, to the field of this bill. As I understand it the bill finally wishes to take coastal stations under Government management, and a good deal has been brought against it on account of the possible danger to the future development of the art. I am an engineer. Fifteen years ago, or 20 years ago—say, 18 years ago—there was some doubt as to the connection between the transmitter and the receiving apparatus. To-day we know exactly what the transmitter is supposed to do, and exactly what the receiver is supposed to do. So it comes down to-day to a question for the engineer to design an apparatus that will yield the best efficiency at a certain current, say, a high-frequency current. Whether we then use that current for electric mechanical purposes or for radio purposes is very immaterial. Therefore, if any inventor or designer of radio apparatus wishes to devote his time to the development of the transmitting end, there is no need for him to go and shoot high-frequency currents into the air, or into the ground, or some other means of radio communication. He can do all that in his own laboratory.

I have, I think, more radio stations on board ships—battleships—and in the navy yards, and at the Panama Canal station, which Capt. Bullard mentioned and described as a very fine station; and I have done all of this work without any antennæ. That is, I have developed what the Navy has considered and I understand considers to-day the best available apparatus, and have done it without disturbing anybody in the air, and there is no drawback in doing that. Therefore I do not see why the Government ownership and restriction that private concerns should not send out messages would interfere with the progress of the transmitter apparatus. It has simply come down to an engineering proposition, to design a generator of high frequency, and having in mind what the generator is going to be used for afterwards.

As to receiving, the bill does not touch it, I think; that is, anybody can receive and experiment and improve, and there is no reason why the bill should hamper the development of the receiving end. The only hampering of any development might be in the cooperation of the transmitter and receiver as actually used in practice. That does not include the interference proposition at the receiver end, because that can be taken care of without very much frequency of cooperation with the transmitter. Anybody can put up a receiving station and there experiment on the elimination of static interference by listening to signals that come from any transmitter station. And I should liken the question of going out with a transmitter into the air, an experimental transmitter, very much to the proposition that we find preparedness is necessary and that everybody should take a gun and get some practice in target shooting, and it would be all right to let them shoot around on the streets, particularly to let them shoot at people. But they can do that just as well and get the practice in a shooting gallery.

I have a note here to say something as to patent rights. I am not a lawyer, but I was the first man in a suit which a competitor brought against me to maintain that I had the right to manufacture under a patent right any article bought by the Government because a patent right does not include exclusive use as applied to the Government. And the courts have upheld me in that contention.

The CHAIRMAN. How is that? Please state that again.

Mr. LOWENSTEIN. I will state a concrete case. I say I was sued by a competitor for an infringement of patent, the validity of which does not enter here into this discussion. I did not want to bring the validity before the court at that time, for several reasons which still hold true now, so I relied entirely on the scope of the patent right to that company. A patent is issued to a patentee for his exclusive right to make, sell, and use an invention to the exclusion of other citizens, but not to the exclusion of the Government. Now, if any other citizen wishes to use the patent he has to pay a license fee or a royalty to the patentee, and the patentee has a right to say how much the royalty or fee shall be. But if the Government wants to use an invention, it is its prerogative, its right, to do so, and there is a law which provides for compensation to the inventor, and that compensation is to be determined by the Court of Claims.

I mention this point because in reading over this morning the testimony of one of the witnesses, I saw the words used that the right was brutally taken away from the private patentee. Now, I think the Government has a right to do that by law, which is not brutal force.

The CHAIRMAN. The decisions of the court are to that effect, are they not, that the Government has a right to use it?

Mr. LOWENSTEIN. In my particular case the complaining company asked for an injunction and the court ruled that under the act, I think, of June 25, 1910, no injunction could lie against me, neither preliminary nor permanent.

Mr. HARDY. They held that his right was to go into the Court of Claims for whatever compensation he was entitled to?

Mr. LOWENSTEIN. Yes. I think that, up to the act of June 25, 1910, the question of compensation, of what the patentee could get for anything was uncertain as to its application to patent rights, but that act made patent rights equivalent to any other rights in that respect.

I am not a military man, but I think that the air can not be owned by anybody else except the military authority when it comes to a crisis in the country. And we have no time then to go and arrange to organize a great variety of great different interests into one military establishment. I do not believe in any copartnership in the air, nor would I believe in any copartnership in a wire line. The wire telegraph, however, is entirely different from the radio question. If the Government wishes or is in need for any particular purpose to use a wire line from here to Philadelphia, it can easily, if not using existing lines, build another line near it, next to it. But you can not do that with the air.

A great deal has been said about channels, likening a channel to a separate wire. But we have not come to that point where we can talk over a great number of channels in the air, and I do not believe in any copartnership in the air.

The point has been brought out, too, that the Navy operators are inferior to the civilian operators of the commercial companies. I have had a great deal to do with the naval operators, and I have found a good many who were rather medium, but I have also found

many who were very excellent. Now, I am not actually an operator; I can not myself receive any message nor transmit any message to any ship. I am not an operator; I am an engineer. But if it is true that the Navy operators are inefficient to-day, so much more reason that every single station in the United States should be handled by Navy operators so as to make them efficient.

If you have any questions, I would be glad to answer them.

Mr. HARDY. I judge from what you said that you are the gentleman who made the apparatus for the Government that another witness referred to as having been brutally robbed of his rights?

Mr. LOWENSTEIN. No, sir; not me.

The CHAIRMAN. But you did have a case of that kind, in which the only defense you put up was that you did not question, for the sake of the pending case, the validity of the patent, but you did question the right of the patentee to enjoin you from making these instruments or apparatus for the Government?

Mr. LOWENSTEIN. I do not understand your question, sir.

Mr. HARDY. I understood you to say that in a certain suit you rested the proposition solely upon the right of the Government to make patented apparatus and to require the patentee to apply to the Court of Claims for his remedy?

Mr. LOWENSTEIN. Yes.

Mr. HARDY. You had a case of that kind?

Mr. LOWENSTEIN. Yes, sir.

Mr. SAUNDERS. In other words, as I understand, the effect of it is that any patented device that is on the market to-day can be made by anybody who chooses to make it, provided that the vendee in that instance be the Government?

Mr. LOWENSTEIN. Yes, sir.

If I may also make another remark here, it has also been said that if there is to be a monopoly of the air, then let it be a private monopoly and not a Government monopoly. I think that is a play on words. Those two words monopoly are entirely antonyms and not synonyms. The only monopoly of a Government is a monopoly by prerogative—a high right—the other monopoly is a selfish act of business to get more money into their own pockets than the other people, or to get some of the public money into their own pockets. Those two words “monopoly” are entirely different monopolies. In other words, I have dealt with the Government for 10 years, and I find I fare much better with the Government, as far as rewards are concerned, with my inventions than I do or would fare with any private monopolistic interest.

STATEMENT OF MR. CLOYD MARSHALL, OF NEW YORK, WIRELESS IMPROVEMENT CO. OF NEW YORK.

The CHAIRMAN. Give the committee your name and state whom you represent.

Mr. MARSHALL. Cloyd Marshall, Wireless Improvement Co., of New York.

Mr. SAUNDERS. Will you state your connection with that company. Are you an expert, scientist, or simply an associate in the business?

Mr. MARSHALL. I am an officer of the Wireless Improvement Co., and I have had charge of manufacturing the wireless apparatus for various companies prior to my connection with this one, the United Wireless, De Forest Wireless Specialty, and I was also associated with the Marconi Co. for a time.

The CHAIRMAN. I recollect you were before this committee once before, were you not?

Mr. MARSHALL. Yes, sir.

The CHAIRMAN. In 1912?

Mr. MARSHALL. Yes, sir; I appeared before this committee and also appeared before the Senate committee on numerous occasions with reference to the ratification of the Berlin Wireless Convention. I want to call your attention to the fact that the conditions in this country are immeasurably better to-day than they were at that time, before those laws went into effect. Radio operation must have Government regulation and the regulating features of this bill, I think, should have the support of everyone in the wireless field. Those who are opposed to this bill I well remember represent the same interests that were opposed to the Berlin treaty and the regulating bill of 1912.

Another feature which is very commendable from the standpoint of American wireless companies and American citizens is that limiting alien ownership. Some seven or eight years ago I called Commander Todd's attention to the peril of foreign companies establishing great and powerful wireless stations on our North Atlantic shores, where they had complete supervision of all the messages and orders that were transmitted to and from our naval vessels. I think that should be stopped now and forever. We should have no land stations in the United States owned by Englishmen, Germans, or Frenchmen as there are to-day and have been in the past. It seems to me there can be no question about that. It is a matter of safety and protection for our Government. In sending out wireless messages, even under censorship, some of them that look very innocent may convey meanings which are detrimental to our country in time of peril.

In the preceding testimony I find some statements have been made with reference to the value and extent of wireless coastal stations that are very exaggerated. This is not as great a property proposition as these gentlemen have led you to believe. I had taken and have had charge of inventories for 63 coastal stations and about 520 ship stations at the time when they were conveyed from the United Wireless Co. to the Marconi Co. and I know exactly what those stations cost. Also I have charge of manufacturing this apparatus and I remember exactly what it cost prior to its installation. Of course, that was about five years ago, and wireless apparatus is more expensive to-day. But I will tell you this, that all those coastal stations, with one exception, were on leased land and consequently their improvements were of a more or less temporary nature. They have no costly structures or towers, such as the Navy and Army stations, because some of the leases were for a short term of years, and when terminated, the wireless property would be practically destroyed.

In passing such a bill as this, providing for Government ownership of coastal stations, you do not have to take all of the land

stations. There would be not more than 100, maybe less than 90, that would be desirable for the Government to own. There is absolutely no occasion for the Government to acquire the other 250 land stations, because they have nothing to do with ship service. Outside of these there are some 5,500 stations which belong to amateurs. There is no idea of acquiring any of them or regulating them in any different way by this bill than in the law which is now in effect. So that the idea of the enormous cost of acquiring coastal wireless stations is erroneous. The cost would not amount to millions of dollars as stated. Of course there are a few of the shore stations, like those of United Fruit, which are very substantial, well built and constructed, and also several of the transoceanic stations like those of the Marconi and Federal companies. The coastal stations which take care of the American merchant marine are of comparatively small value. It seems to me, as one who has been identified with this industry for the last 10 or 11 years, that it would be very advantageous if the Government would take hold of all our coastal stations and serve the shipping interests. It would save a duplication of stations at every important port.

My observation is contrary to the testimony of some of the preceding witnesses that the Government apparatus is very inferior. It is not inferior, but the best that can be purchased. Much to the despair of some of the contractors, the Army and Navy Departments are continually pushing specifications so far ahead that it is with the utmost difficulty that we are able to comply with them.

The CHAIRMAN. I understand the Marconi people concede they are using the spark system, the damped-wave system, and the consensus of opinion seems to be that that is not now the best system.

Mr. MARSHALL. The arc or undamped wave system, such as the Navy is using at present in its large stations, is for long-distance transmission. The spark system up to date has been the most available for commercial ship installations, because the spark system can easily be built to comply with the laws now in effect with reference to wave lengths.

The CHAIRMAN. The coast stations use the spark system, do they not?

Mr. MARSHALL. Yes, sir.

The CHAIRMAN. The coastal stations?

Mr. MARSHALL. The commercial stations, except the Federal Telegraph Co.'s and some of the naval stations all use the spark systems.

With reference to wireless patent matters, Mr. Lowenstein has explained that so fully I will not say anything more, except that in my dealings with the Government I have found the officials to be as fair, or fairer, than the commercial interests. As for myself, I am willing to deal with them in the same way that we have done in the past. If this bill should become a law and the Government acquire some 90 coastal stations, it is not going to affect adversely the interests of my company or other radio companies, except to broaden and make more free the use of wireless telegraphy.

I thank you.

The CHAIRMAN. Is there any other gentleman present who wishes to be heard?

STATEMENT OF MR. LOUIS COHEN, WASHINGTON, D. C., PROFESSOR IN RADIO ENGINEERING, GEORGE WASHINGTON UNIVERSITY, AND CONSULTING ENGINEER.

The CHAIRMAN. Are you interested in any of these companies financially?

Mr. COHEN. No, sir. I have been interested in wireless telegraphy for the past 10 years.

The CHAIRMAN. Are you in their pay in any way?

Mr. COHEN. No, sir.

The CHAIRMAN. You are not receiving a salary from them for your research work?

Mr. COHEN. No, sir. I have been interested in radio work for about 10 years. I was engaged for four years with the Bureau of Standards here, giving my attention exclusively to the technical and scientific problems. Then I was for three years with the National Electric Signaling Co., where I had charge of research and development work, and where I had an opportunity to get acquainted with the practical part of it. And since then I was engaged for the past four years in development work in developing some of my own inventions in wireless telegraphy.

A great deal has been said here as to the possibility of stifling the art in the development of wireless. It would seem that the private wireless companies are greatly concerned or chiefly concerned about the interests of the inventors and the progress of the art. Now, I am about to relate to you briefly my experience with the Navy Department or the Signal Corps for the past four years, which will throw some light on the question and show whether the Navy or Government departments are assisting with the development of the art or whether they are stifling the development of the art.

I recall that about four years ago I conceived an idea for a new wireless receiver, which I believed to be far more efficient, as it is a far more selective receiver. I worked the problem out mathematically, and then I submitted the proposition to the Navy Department in writing. I was in Boston at that time. I did not know any of the naval officers personally, and I just simply sent them a statement explaining to them the idea and proposing to them that they should take up the matter and build a model in their navy yard. I received a reply stating that they would be glad to consider the matter if I came down to Washington and demonstrated to them precisely what could be done. I accordingly arranged to come to Washington, and I gave them a laboratory demonstration of that new idea. They were satisfied with it, and they said to me, "Now, we will build a model for you in our navy yard if you will submit your designs, and then we will test it under actual, practical, working conditions, and if it is satisfactory we will then make some arrangement with you." The model was built and turned out satisfactorily, and in the course of time when my patent issued I entered into negotiation with the department and very quickly arrived at an equitable arrangement by means of which they acquired the right to manufacture and use those receivers. And I am glad to say that those receivers are now used extensively by the Navy Department and the Signal Corps, something like 300 or 400 of them having been built, and they are giving excellent service.

Since that time I developed another improvement for the Navy Department, practically at the request of the Navy Department. They submitted the matter to me and said, "Here is a problem in which we are interested, and if you can develop it for us, we will, of course, make some arrangement with you." The thing has not yet been quite perfected—the patent has not been quite perfected, but I have every confidence and every right to believe that as soon as it is perfected and developed, we will make some suitable arrangement.

Now, I know, from experience in the past four years, that on a number of occasions I was called in on consultation work with the Navy Department Signal Corps. I know that the officers of the Navy Signal Corps are always very keenly alive and interested in anything pertaining to the progress and development of the art. Their principal concern is service; they want to get the best there is available, the best that is possible; and not only do they not discourage development, but I believe they stimulate a number of independent inventors to develop the art. Just the other day I was called into conference by the Signal Corps, by some of the officers, in respect to the development of wireless apparatus for aeroplanes, and one of the officers told me—he says, now they are much afraid they are falling behind as compared with the equipment used by foreign countries and they want to forge ahead. In other words, it is not a question with them merely of using what is available, but they are always thinking and encouraging inventors to do the best they can in developing the art.

Further, some considerable work of a scientific character has been done under the supervision of the Government, of the Navy Department, and the Signal Corps, which no private corporation would ever think of doing. Take, for instance, the fundamental scientific law governing the transmission of wireless telegraphy. The officers and engineers of the Navy Department conducted a large series of tests which enabled them to obtain a formula by means of which they can predetermine what the power of the station should be, what the height of the antennae should be in order to cover a certain distance. That is one of the fundamental laws which is used now in the designing of all the wireless stations. I venture to say that no private enterprise would have undertaken such an investigation, an investigation of a character which involved certain character of equipment and great expense. I have always found that the officers both of the Navy and Army are only too glad to cooperate with anybody, with any of the inventors or engineers, who have something of value to present to them which looks fairly reasonable and has some scientific basis.

Now, it has been said that a Government monopoly would be bad and a private monopoly could never be formed, for the reason it has been maintained that the ether is free, the medium of transfer is free, and it will always be possible for any other capital to develop a new system and compete with existing companies. As a matter of fact that is not the way it works out in practice. Aside from offsetting the freedom of the ether that has been suggested here, here is another feature that enters into it; suppose you have a company of considerable financial backing and establishing a chain of stations

and they want to control wireless transmission. Now here comes along another man, and he has a new invention, let us say, he also wants to put in a few stations and operate them. It would be the simplest thing in the world—as a matter of fact, it is the policy pursued by private companies—to litigate that inventor in the patent office until he is out of business. It is well known that there are infringements of practically all existing patents. All that is necessary is to read into all patents such an interpretation as to make it appear you are infringing prior patents, and in that way they cut off all competition. I know, for instance, they spoke of encouraging inventors—

The CHAIRMAN. Right at that point—I am a member of the Committee on Patents, and have been for years, and that is a very favorite, popular way of strangling a new invention.

Mr. COHEN. Yes, sir.

The CHAIRMAN. By litigating them to death.

Mr. COHEN. Yes.

Mr. SAUNDERS. In the same connection, you suggested there a possibility that would apply to every field of invention.

The CHAIRMAN. Certainly.

Mr. SAUNDERS. Take, for instance, an ordinary thing, such as the typewriter; why, that has been developed, and scores upon scores of different styles of typewriters have been developed from year to year, although the possibility of some great typewriting concern stifling the thought of all of these people and involving each new typewriting invention in litigation and strangling them out, that is a possibility that attends that and every other field of invention.

The CHAIRMAN. I can quite readily see that, theoretically, you can succeed in organizing a company with the same financial backing as the existing company, and then they go out and probably fight it out between themselves until they finally agree to divide up the field or one goes down. But I am speaking here from a practical point of view of the engineer and inventor and the man who is going along and trying to develop the art.

Mr. SAUNDERS. You are suggesting the possibility in the field of invention that if the Government was not in control, the strong company can stifle and head off new development.

The CHAIRMAN. Yes.

Mr. SAUNDERS. And, as I said, that applies to every field of invention.

The CHAIRMAN. Yes. Theoretically, the air is free and the ocean is free; but, practically, up to the time the war broke out the ocean was not free. It was controlled by combinations and agreements as effectively as transportation by land. This committee disclosed that condition in the investigation of the so-called Shipping Trust. So that it is all right to speculate about these questions, but we ought to look the conditions squarely in the face.

Mr. SAUNDERS. I understand, but I just wanted to put in a little counterspeculation.

Mr. COHEN. Just to illustrate the conditions as to how the Government departments treat the inventor or the man who makes an improvement in the art as contrasted with private corporations, I say that my own personal experience in this case was as follows: For instance, I came to the department and told them that I had a

new idea. They believed it was good and had it tested out and found it was satisfactory, and then they made a satisfactory arrangement to reward me for my efforts. Now, I was connected with a private wireless company before then, and from my own personal experience several inventors sent in patents or applications, asking the company to consider whether they would buy the rights. Those applications were referred to me for opinion. I looked those over and found they were good working improvements, and I recommended their purchase. But when it came to the manager, he said: "Now, we have here an organization, and we can develop our own inventions; if we can not use this particular invention, why, we can make something similar to it." There the man suggested the idea, and it is comparatively a simple thing to make another device or another arrangement which will accomplish the same purpose.

Now, I believe that is the attitude of the private corporation, while the attitude of the Government is entirely different. I merely wish to bring out this point just to show the difference between a private corporation and the Government in regard to the question of stimulating the development of the art.

It has been pointed out here that Government ownership will amount to a suppression and stifling of the art. My own personal opinion, which comes from my experience, is that the contrary is the fact. Of course, there is this to be said, that under private ownership if they happen sometimes, due to an exceptional combination of circumstances, the inventor may reap a bigger reward than it is possible to obtain from the Government. But, on the other hand, I maintain Government ownership has this advantage from the point of view of the inventor—that there is an element of certainty in it, and he knows he is going to get some consideration for it.

Furthermore, I have always found the Government departments were willing to cooperate with the inventor and offer him their facilities for improving his invention if it is to the advantage of the Government to have that particular improvement. And I believe that most of the engineers and people who engage in the art, if you assure them of this thing, of cooperation and an opportunity to develop their inventions, together with the certainty of a fair return for their work, and public recognition for their work, that those factors are amply sufficient to encourage all inventors to cooperate with the Government and do the work. Of course, in every human institution, whether it is private or Government, it is not perfect; it has its faults. But I—at least for my part, and I believe there are a good many other engineers with me—would much rather take a chance with the Government and the representatives of the Government than with any private corporation.

I thank you.

Mr. FORD. There have been some references in the testimony to the Wanamaker stations in New York. We have letters here from the general manager of the Wanamaker Co., of the New York offices, and also from one of the managers of the Wanamaker station, which we would like to have incorporated in the record as showing the experience of those stations in this matter of interference and the operation of the stations.

Mr. HARDY. Do they add anything to the testimony of the gentlemen here about that matter?

Mr. FORD. It is simply the statement of the practical men who have had immediate relations with the stations.

Mr. HARDY. What I mean is, we have not the substance of it in the record?

Mr. FORD. No.

(See p. 217 for letters referred to.)

Mr. HOGAN. In that same connection, I was asked certain questions concerning interference at our stations, and I have a letter here from the operator in charge of that station reporting on interference from stations around New York Harbor.

Mr. ROWE. Which station is that?

Mr. HOGAN. The Brooklyn station of the National Signaling Co. I would like to have this appended to my testimony, if I may.

Mr. ROWE. I think that ought to go in.

Mr. HOGAN. Would you like to have this read, or just embody it in the record.

The CHAIRMAN. State the substance of it.

Mr. HOGAN. It is to the effect that there is no interference experienced by the Bush terminal station from the Wanamaker station which uses a wave length of 1,700 or 1,800 meters, and which is just across the river; from the Lackawanna station, or from the navy yard station; that is, when the Brooklyn station is receiving from near-by ships, that station sometimes causes some slight interference with weak messages. But there is no interference at our stations from Sayville or Tuckerton, the high-power stations which were complained of. There is interference with the ship wave length. When two ships are sending on the same wave length, there is, of course, some interference, as we have already discussed.

(The letter above filed by Mr. Hogan is as follows:)

NATIONAL ELECTRIC SIGNALING Co.,
Brooklyn, N. Y., January 22, 1917.

Mr. JOHN L. HOGAN, Jr.,
Chief Research Engineer (Supervising Operating Department),
National Electric Signaling Co., Brooklyn, N. Y.

DEAR SIR: As you have asked, I am writing concerning the interference situation in New York Harbor. I have been operator at the National Electric Signaling Co.'s Bush terminal, Brooklyn, station since May, 1912, and have had much opportunity to note the various interferences which exist in the vicinity of New York. At this port we, of course, have the maximum amount of interference because of congestion of ship traffic, on the whole, however, we are able to get all messages through with comparatively little delay, by reason of the various traffic arrangements which are in effect. That is, we have cut down the actual amount of transmission to an absolute minimum and are therefore able to handle our messages with very little actual sending. If we were not required to use 600-meter wave length to all ship work by the London convention, I believe there would be absolutely no difficulty in simultaneous operation of a number of stations in the same general locality. As it is, however, we must, of course, alternate with the Sea Gate station, which uses the same wave length, or approximately the same.

At this station we get practically no interference except from ships or shore stations using the wave length upon which we operate. Of course, it is not possible to read weak signals through interference on the same wave as that of the signals. If there is any difference in the two wave lengths, however, we are able to tune out the interference stations to such an extent that our business is delayed very little if at all.

To take specific examples, I will point out that within a few miles of us there are located the Wanamaker station, which sends on a wave length of about 1,800 meters; the Delaware, Lackawanna & Western Railroad radio

station, which sends on about that same wave length; several stations of the Army, which operate on some 1,200 to 1,400 meters; the navy yard, which sends on some 960 to 1,200 meters, as well as a large number of amateur stations using wave lengths below 200 meters.

In working with ship stations we use wave lengths of 550 and 600 meters. In this work we get no interference from any of the above stations except, at times, the navy yard. Occasionally, of course, an amateur will get outside of his restricted zone, including wave lengths up to 200 meters, and will send on a wave which causes some interference. This is always on account of improper adjustment of his apparatus, however, and we have no difficulty caused by amateurs when they operate correctly.

Even the navy yard interference is not ordinarily serious. We can receive messages of normal strength even when the navy yard is sending, but since they transmit some of their energy at the best wave length, we are not able to hear any faint messages at the same time that they operate. If the navy yard transmitters were as carefully adjusted as that of other stations near here, his transmission on wave lengths longer than 960 meters would cause us practically no interference, and in fact probably none at all.

In addition to the above-named stations we are within a comparatively short distance of the high-powered trans-Atlantic stations of Sayville and Tuckerton. When we tune to the wave lengths sent out by these tremendous plants we receive enormously loud signals. When, however, we are working on the ship wave lengths we do not hear any of the transmitting messages from either of these two very powerful plants.

Speaking generally as to the interference situation, I may say that we are able with our apparatus to tune so sharply and selectively that we experience practically no interference from any station except those which transmit on the ship wave lengths used by us. Since we are limited to certain wave lengths by the provisions of the London convention, and since other ship and shore stations engaged in ship traffic are forced to use those same wave lengths by this law, there is of course some interference on this account. I have explained this above. However, at our station in Brooklyn we have no interference from any other station operating on wave lengths which are not used by us. Any station which radiates energy on the wave which we are receiving, of course, interferes with us if he is close by.

Very truly, yours,

R. J. VOSBURGH.

(Thereupon, at 1 o'clock p. m., the committee adjourned until tomorrow, Wednesday, Jan. 24, 1917, at 10 o'clock a. m.)

RADIO COMMUNICATION.

COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
HOUSE OF REPRESENTATIVES,
Washington, D. C., January 24, 1917.

The committee met at 10 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

The CHAIRMAN. Commander Todd, are you ready to proceed?

Commander TODD. As you will recall, yesterday afternoon Mr. Penfield and Mr. Davis made some remarks of a political nature which you heard in closed session. The information of the committee on those points is not complete, in that there is more to the story of which the United Fruit Co. is not as cognizant as I am, and I will ask the committee while that is still fresh in their minds, to be permitted to talk a little further on that matter.

The CHAIRMAN. You want to be heard in executive session?

Commander TODD. If you please, sir. The matter is entirely of a political nature.

The CHAIRMAN. Are there other persons this morning who desire to be heard in open session?

Mr. FORD. I have a letter from Mr. B. L. Thane, of San Francisco, who is largely connected in mining in Alaska. The letter is addressed to Commander Todd. It probably should have been addressed to this committee. Mr. Thane expresses himself in opposition to the proposed bill. I would like to have this letter incorporated in the record.

The CHAIRMAN. If you will hand that to the clerk it may be incorporated in the printed record.

(The letter referred to follows:)

SAN FRANCISCO, CAL., *January 12, 1917.*

Commander D. W. Todd,
United States Navy,

Chairman Interdepartmental Committee on Radio Legislation,
Washington, D. C.

SIR: I learn from the daily press that an interdepartmental committee has been formed with the object of considering a bill recently drafted, the purpose of which appears to be to authorize the Navy Department to extend its field of influence over all wireless stations situated within the United States and its territories.

I desire to take this opportunity of submitting my protest in the strongest possible terms as I have been for years dependent, in a commercial way, upon the telegraph service rendered by one of the Government departments in Alaska, where my companies operate extensive mines. The service I refer to was extremely undependable and unsatisfactory.

Some two years ago the Marconi Co. extended a chain of stations into Alaska competing with the old Government service and I am safe in saying that the new service has become extremely popular with all progressive Alaskan business men and we should all look askance upon any proposition that might, in any way, eliminate this commercial competition.

I am not in any way interested in the Marconi Co.'s affairs, but wish to go on record as stating that they have rendered splendid service in a most difficult field of endeavor and it does not appear to me to be just or democratic to hamper their operations and progress.

Respectfully, yours,

B. L. THANE.

Commander TODD. Mr. Chairman, we hoped that we could have said all we had to say at the first part of the hearing, but in a subject that is as intricate and which has so many sides to every single feature of it, as this subject has, it is so possible, unintentionally, in answering the questions of the committee, to create a wrong impression, that we feel there are some points that must be brought out.

In our first statements we mentioned no company and no names, nor did we indulge in any criticism. We find, however, at this time that it is necessary to do that.

Also, there have been complaints of oppression, depression, suppression, and what not. Mr. Clark has made a note of all the technical features involved and is prepared to answer questions in full; and I have some features with which I am more familiar than anybody present, to be presented to the committee, following Mr. Clark's statement.

**SUPPLEMENTAL STATEMENT OF MR. GEORGE H. CLARK, EXPERT
AID FOR THE BUREAU OF STEAM ENGINEERING, NAVY DE-
PARTMENT.**

The CHAIRMAN. Let the record show that Mr. Clark is appearing on behalf of the proponents of the bill to make a supplemental statement.

Mr. CLARK. I have learned a great deal in listening to the discussion of this bill, and one of the chief things that has impressed me has been the pessimism that seems to impress the American radio people. They are always claiming, apparently, that legislation will do great harm. But after the legislation has been passed they seem to find that it has not done the expected harm at all; and I am firmly of the opinion that if they would take a chance on the present legislation they would be the first ones to claim afterwards that it was a move in the right direction.

A number of the points that have been brought out will now be dealt with very briefly. With regard to stifling the development of the art, in case the Government should take over the shore stations, I do not see why the adding of 62 stations or so to the 500 that the Navy now has will cause a stifling of the art. It is not as if the Government had control of radio telegraphy and telephony as a whole, including the manufacturing and development work. There is no desire and there is absolutely no intention of taking over those functions. As a matter of fact, a great deal of the apparatus which is now in the commercial stations would be removed in case the Government would take them over, and would be replaced by new apparatus. This would benefit the companies rather than hurt them.

As to the fear lest the withdrawal of the stations would hinder development, a great deal of the development work that is done nowadays is done without actually radiating the energy from a station; in other words, it is done by laboratory methods; by making use of

what is known technically as a dummy antenna, an electric system which exactly represents the antenna, and which has the advantage that it does not send out waves to interfere with actual message work.

The CHAIRMAN. That is the matter to which Prof. De Forest referred yesterday?

Mr. CLARK. That is the matter to which he referred, and Mr. Lowenstein also referred to it. The Navy has done a great deal of work in actually standardizing this dummy antenna and in developing methods by which tests could be made without interfering with commercial work. Dr. Austin has been especially active in that line, and for the very purpose of decreasing interference. There is undoubtedly a great deal of work which still remains to be done under service conditions. In transmitting lines, especially, it is necessary at times to use an actual antenna. The experience of the Western Electric Co. in their use of the Arlington station shows that when it is necessarily actually to make use of radiation the Navy has not stifled development in that line. The greater part of the necessity for actual work, however, exists in the receiving end, and there is no hindrance whatever contemplated in the carrying on of that work.

The question has been brought out about the present activities of the Government in radio matters, and it has been stated that the Government has not made any inventions, but that their work has been merely in the nature of improvements. That is exactly true. That is exactly what the work of the Navy and of the Signal Corps is intended to be. We do not intend to do any inventing and manufacturing, but we do intend, whether this bill passes or not, to continue to make improvements.

We will take, for instance, the commercial wireless receivers which, until a few years ago, were submitted by all companies. Those receivers were good electrically, but when they were placed on a torpedo boat where, for example, on account of high speed and the light build of the boat, the vibration is very excessive, the wiring inside those receivers and other parts simply fell to pieces. It was constantly a question of having these receivers returned for repairs. That was one point we took up—a minor point, indeed—but by a study of the question we developed a method of wiring which would overcome these difficulties. We then asked the commercial companies to submit receivers wired after the Navy pattern, and they have done so, and none of those receivers now break down in service. That is of minor importance, but it means a difference of putting in a set which stays working and with which we do not constantly have to tinker and send back for repairs. What we have to do, thus, is to make the apparatus “fool proof.” Mr. Hogan said that the use of the word “fool proof” was a reflection on the Navy operators. It was not intended to be so; it is simply the attempt to make the apparatus of such a nature that it will last for a longer period of time without requiring repair or attention.

The CHAIRMAN. In service conditions?

Mr. CLARK. In service conditions; yes, sir. We have attempted to recognize the fact that operators are merely operators—they are not engineers; they are not technical men—and we have to deal with them as they are and not as we wish they were. And it is our attempt to make the apparatus so that it will fit these actual conditions.

There has been certain work done by the Government, however, which has been in the line of invention, in the line of measurement work. As I said before, this has greatly clarified the radio situation. Dr. Austin has been recognized as an international authority on matters of measurement and also in matters connected with the receiving of messages. The Bureau of Standards has done a great work in the development of standards for radiotelegraphy, and we are not now dependent on the German standards as we were in the first days of the art.

In the line of pure invention, Col. Squier's work in developing the so-called wired wireless, and his still later and more remarkable invention of a new method of cable telegraphy, should be considered as a very valuable contribution to the art. The Kolster decremeter, which was developed by an employee of the Bureau of Standards, is considered likewise to be a noteworthy development of the art of radiotelegraphy. And there are minor improvements which are being made constantly; and I may say, although I do not wish to emphasize the military side of this thing too much, that a number of improvements have been made which are not considered to be commercially advantageous but have particularly a military advantage. We hope nothing is known of these except in Navy circles.

The question of interference has been brought out many, many times, but I do not think the situation has been clarified by the remarks that have been made. I do not think anyone, on either side, will claim that it is possible to-day to receive a message when another message is being sent in the vicinity on the same wave length. It may be there are methods in the laboratory which will do that; I do not know. But we are dealing with the facts which exist in the actual commercial work at the present time; and how that interference can be gotten over, I do not know. I wish it could be done.

The chief cause of interference has been well brought out by Prof. Pupin. It is, as he puts it, the interference caused by God; or, in other words, the interference from atmospheric sources. The signals caused by what we call static exist on practically every wave length. If you are receiving on one wave length, static is also working on that wave length; and if you change to another wave length, it is very probable that static will be there. That is the chief cause of interference and the hardest to eliminate; and it seems to me that the suggestions made that we need all the interference caused by man that we can get in order to develop our operators is rather beside the point; because we already have a great sufficiency of interference that we can not control by legislation. And why add to that by intentional interference?

Mr. EDMONDS. Excuse me, but what do you mean by "intentional interference"?

Mr. CLARK. Statements were made that we should have as much interference as we could have in order to encourage the art to develop methods of overcoming that interference. I refer to that as "intentional." That term might be modified to state we should not try to eliminate interference caused by these other stations.

The CHAIRMAN. I think those gentlemen said we ought to encourage it. I think their statements would bear that construction.

Mr. CLARK. I think it might be well in that connection to abolish all rules of the road for automobiles. It would make the drivers of

automobiles very much more skillful in dodging each other, and therefore in times of danger the likelihood of collision would be less. Collisions do happen under present conditions, yet I do not see any suggestion made for abolishing the rules of the road in order to make the people any more skillful.

Mr. GREENE. Oh, if you want to put up a proposition like that, some of us might object a little bit. Some of us are a little lame and have to get out of the way of people who want to ride roughshod. You want to ride roughshod, and we want to curb you a little.

The CHAIRMAN. We want to observe the rules of the road.

Mr. HADLEY. The last statement was a suggestion to eliminate all rules of the road.

The CHAIRMAN. I did not take that seriously.

Mr. GREENE. Oh, if they want to joke, we want to joke a little, too.

The CHAIRMAN. I regard it as a piece of fine humor.

Mr. CLARK. The use of the 600 meters for commercial work by ships will be treated by Commander Todd later, and I think he will show very clearly that the Marconi Co. itself was very instrumental in requiring that wave length to be kept for ship work. And at that time it was very fitting that they should. There is a point which has not yet been brought out, and that is if you want to be sure that the call you send out is going to be heard you have got to be sure that some one is listening in on that wave length, or very closely to it. For that reason it was desirable that all ship work should be 600 meters. Not until the development of wave changers by the Navy Department was the Navy able to get away from working on one wave length. For a number of years the Navy worked on one wave length, known as the "Navy wave"; I think it was 450 meters. We found it was desirable to get away from that, but we also knew that it was undesirable to work on different wave lengths and expect that the receiving operator would by some chance be atuned to that wave length at that particular moment. So for that reason we developed a quick method for changing the wave lengths and a system of calling on one fixed wave length and then changing to some other wave on which both stations worked by mutual agreement. But at the time the Marconi Co. suggested that the 600 meters be made standard, their point was very well taken.

Now, a point I wish to bring out is that it is not the ship stations that are interfering. We are not claiming that. It is the shore stations that are interfering with the ships and with each other, as well as with the Navy. Commander Todd will show you a chart showing you how congested the wave-length situation is at the present time between 600 and 15,000 meters. All we desire is to bring the shore stations into harmony so that they will not intentionally or unintentionally interfere with each other. When this chart is shown and the suggestion which is evident is likewise shown, I think the necessity for regulation will be very clear.

Mr. EDMONDS. I am not an expert, and I would like to ask you a question there: Could not every station have a certain meter length and work on that?

Mr. CLARK. That is exactly what this bill is intended to do, sir; to require that they do that by putting them all under one control so that they will work on definite assigned wave lengths.

Mr. EDMONDS. Would not that be possible and still leave all the commercial stations as they are? Would it not be possible to give each commercial station and naval station a certain working wave length and have them work on that?

Mr. CLARK. I think the question there comes to the question of what always happens under a divided authority. If the control is under one head so that there will be no conflict of authority and no questions brought up that can be done far better.

Mr. EDMONDS. You could have control without ownership, could you not?

Mr. CLARK. It is possible now to have such control, but it is not done. Those are matters, however, which I would rather have you ask Commander Todd about, because I am dealing only with the technical side.

Mr. EDMONDS. That is what I am asking you.

Mr. CLARK. That is the regulation side, as I understand it.

Mr. EDMONDS. Is it not possible to take the stations we have to-day and so regulate or control them that they could get along comfortably without Government ownership?

Mr. CLARK. If the regulation of wave lengths is sufficient, I should say yes, as far as I can see.

Much has been said about interference between the Wanamaker station in Philadelphia and the New York yard. Mr. Hogan says that at the Bush terminal his station is not interfered with on the ship service by the Wanamaker station. Very true; the ship service is on a widely different wave length than the Wanamaker station. On the other hand, the wave lengths of Arlington are very close to that of the Wanamaker station, or relatively close, and therefore it is much more difficult to cut out the interference. As to Mr. Armstrong's having cut out the interference by the apparatus he set up at the Lackawanna station, it is not a difficult matter generally to cut out the interference if you set up special apparatus just to receive the one wave length you want to receive, and also if you have an engineer to superintend the manipulation of the apparatus. But where you have to have a system of receiving where one minute you will have to be receiving from a submarine on a short wave length and the next minute the schedule calls for a long-distance station and you have to go to that long wave length, that makes it more difficult to cut out any one wave length merely because of the multiplicity of receiver conditions that enter in. Dealing with things as they are, and not what might be an ideal in the laboratory, it is a much more difficult proposition to deal with this practical question than it is under laboratory ideal conditions. However, a great deal of the trouble of interference at New York has, to a great extent, been eliminated by a special study of the problem. That has been done quite recently.

Mr. EDMONDS. It is suggested now that in New York you can do that; is that the idea?

Mr. CLARK. It has been done. I was talking to the officer yesterday who has succeeded in eliminating that interference.

Mr. HARDY. Might not that be a very practical and useful lesson? If, in the presence of definite kinds of interference, you have been able to eliminate it, is not that very practice and experience in doing that likely to be valuable to the department in case willful interfer-

ence were attempted, as it would be in time of war, possibly? In other words, this gives you some experience in eliminating interference when it is attempted to be made; and do you not need that experience to meet the emergencies of war?

Mr. CLARK. All experience is very valuable, sir.

Mr. HARDY. But if you had it so that the interference would be guarded against from both sides, you would not get that experience, would you?

Mr. CLARK. We always have the interference which we can not control, and that is the hardest by all means to control.

Mr. HARDY. You mean the static?

Mr. CLARK. Yes, sir. And also, so far as the Navy is concerned, there is constant practice under battle conditions with the kind of interference you must expect to meet. We do not neglect that feature. It is probable it will be used in war time—in fact, it is sure that it will be used—and we do not neglect that feature at all. But for carrying on the business of the country and the Navy's work in peace times I do not see any advantage in having such interference in the air. And, if so, why not make it intentional while you are at it?

Mr. HARDY. I am just speaking about this experience in overcoming interference there in New York, which was not presented to you as a problem to work out like a dress parade, but was coming unintentionally, and you overcame the interference, the creation of which you had nothing to do, meeting it as you would have to meet it in war conditions when it would be presented purposely. The experience is useful to you?

Mr. CLARK. The experience is useful to us. The means which were used to overcome the interference, however, was not something which was developed for that particular purpose; as it happens in this case, the officer who went up there made use of apparatus and methods of connection which had been developed for other work and not for the purpose of overcoming interference.

Mr. HARDY. Now, if I understand you, in reference to the testimony of Mr. Armstrong, I believe it was, who said he succeeded in having no interference by using a little apparatus set up especially for the purpose of making the test.

Mr. CLARK. Yes.

Mr. HARDY. As I understand, you say that would be very easy to do with one wave length, to have apparatus especially designed to protect against interference?

Mr. CLARK. Yes, sir.

Mr. HARDY. But practically you have apparatus which has to use a number of wave lengths?

Mr. CLARK. Yes, sir.

Mr. HARDY. And you would have to have for the entire number of wave lengths the same engineering device which you would have to have for the one?

Mr. CLARK. Yes, sir.

Mr. HARDY. Therefore it is much more difficult than it would be for a practical demonstration?

Mr. CLARK. It can be done if you have enough sets of apparatus and enough money to buy them, because wireless apparatus costs a lot of money and we have a limited appropriation and we have to try to make it stretch as far as we can in other ways. The Navy's work

is diversified, much more so than commercial work, hence the situation is much more complicated. We have small-ship stations and long-distance stations, all of which must come in at the same receiving source, and we must be able, by virtue of the various sizes of those stations, to work on all wave lengths, and it is impracticable at the present time to have separate receivers for all cases. There may be a time in the future when we will have separate receivers for all wave lengths, but we can not afford to do that now.

Mr. HARDY. As I understand, you have now practically overcome the interference around New York?

Mr. CLARK. I am referring to the interference from the Wanamaker station; that was eliminated; yes, sir. The Arlington station can now be received without interference from the Wanamaker station.

Mr. GREENE. Is it not possible that you can do away with these other things which you say are in the way now?

Mr. CLARK. Undoubtedly we can make improvements all the time, sir; but we can not eliminate interference on the same wave length.

Mr. GREENE. You have not been able to do it up to date, but is it not possible you may be able to do it in the future?

Mr. CLARK. I think we should deal with the apparatus and devices known to-day. If some other kind is brought out by the laboratories or by the operators or inventors in the future, it may be that those will be made use of. But at the present time, I myself, as a practical man, prefer to deal with practical developments. The apparatus I referred to at the New York end eliminated interference from a station which had a wave length somewhat different from the one it wanted to receive; but it did not solve the problem of receiving on the same wave length. Personally I have never yet seen apparatus which will do that, although I do not by any means say it can not be done.

Mr. GREENE. As a practical proposition?

Mr. CLARK. Yes.

Mr. EDMONDS. Could not the stations along the coast each have a special wave length given to them under their licenses, and then could not the ships be so arranged that they could adjust the apparatus so as to localize their talk to the station that was nearest?

Mr. CLARK. Under ideal conditions, if all the stations had the same power and the ships did not have to go close to a station that was sending and which they did not want to receive, yes. But under actual conditions, where you can not lay out, of course, the lines of vessels and where stations have different amounts of power, the problem becomes very much more complicated; for example, when a high-power station is sending, the smaller stations in the vicinity are so overpowered by the huge amount of radiation in their vicinity that it actually deadens their detector, if the detector is of the form in greatest commercial use to-day. That probably can be overcome in the future, but the development has not gotten to that point yet. The brute force of those high-powered stations makes it very difficult to work in their vicinity, even though the wave lengths you are working on are widely different from that of the high-power stations.

Mr. EDMONDS. Could not a station at Boston, say, have 600 meters, one in New York have a wave length of 700 meters, one at Atlantic

City 800, and one farther down the coast, at Norfolk, 900; and could not the ship so be tuned, knowing it was near the Boston station, as to be able to talk on the 600, and when it was near the Norfolk station to talk on a wave length of 900 meters? Could they not be licensed that way, so that each one would have a special wave length, and the ship would talk to the nearest one on the wave length of that station?

Mr. CLARK. From an engineering point of view, yes; because that is exactly what the Navy does. They call on one wave length, which is common, so that the operator is always listening on that wave length and each station is definitely assigned a given wave length, just as you have outlined. The question whether that could be done under dual control is a matter of administration which is a point I am not prepared to answer. Commander Todd will cover that point. But from an engineering point of view, if the stations are all on a different wave length; yes. Your statement covers exactly the present practice of the naval stations.

Mr. EDMONDS. That is what you would do if you had all of these stations?

Mr. CLARK. If we had all of these stations, we would take the present sheaf of wave lengths and coordinate the other stations with them so they would all be equally spaced around the circle. And it is by such control in our work that we are able to do that.

Mr. EDMONDS. If you had the control, or if a bill was passed that would control the wave lengths of the different stations, so that the department would have power in the giving of licenses to prescribe the wave lengths of those stations, you could then control the situation without the Government owning all of the stations?

Mr. CLARK. I should imagine it could be done that way.

As to the question of patent rights, the Navy Department has no ability whatever to pass on the question of patents. That is a matter for the courts and is one in which we should not interfere, and we do not. If we paid attention to patents, we would never buy a single piece of apparatus. I do not recall a single time when we have put out proposals for bids, that a number of companies have not stated that if we bought any apparatus other than theirs we would be infringing their fundamental patents. So that if we followed their statements we would end by not getting anything at all. The only way we can do is to carry out our duty, which is to equip the ships and stations for military work.

Mr. EDMONDS. Are these companies fighting out their patents in the courts to-day?

Mr. CLARK. They are constantly doing so; yes, sir.

Mr. EDMONDS. Are the fundamental patents still in the courts to-day, or have they been decided?

Mr. CLARK. The fundamental patents are being fought out. There are a number which are in court now and which are just about to come to the court, I understand. We follow those with a great deal of interest, and when they are finally decided then that will be a matter which can be taken up. But at the present time the situation is just as complex as it was in the early days. The only thing we can do is to ask the companies or express the desire that they settle those matters among themselves, so that the company

which supplies the apparatus to us will include all the improvements of all the patents as to the minor parts which comprise that apparatus. We can not very well buy a spark gap from one person and a condenser from another, and something else from another, and put them all together. We must buy the apparatus as a whole, from one company, so that it can be tested by that company before it is delivered to us; and the only one course open to us is to buy from the company that makes the best apparatus, because that is our duty to get the best system we can. We do to some extent recognize patents which are universally recognized by the commercial companies themselves. That is, just from the commercial point of view, not the legal point of view at all. We have bought practically all crystal detectors, for example, from one company because from our point of view that company has had a monopoly, apparently a natural monopoly of the situation, since no one has offered to sell us crystal detectors of a better class or even of the same class.

Mr. EDMONDS. But they have the monopoly because it is protected by patent, is it not?

Mr. CLARK. Apparently. In this case, however, no one else claims the patent, while with other apparatus just as important, which is apparently protected by patent, there are many people who claim the same patent. It seems that many of the major ideas of radio were conceived at somewhat the same time by different companies, and naturally each company thinks it has the fundamental claim. Hardly a single instance can be brought out where more than one company can not be shown to be claiming the invention. It sometimes happens that the contractor who has his office in his hat, so happily referred to by Mr. Hogan, also has brains in that hat and he produces a better piece of apparatus than some larger company. I do not see that anyone can deny it is the Navy's duty to get that piece of apparatus if by doing so it will serve the Navy's purpose better. This was actually the case in the instance referred to.

In another example, Mr. Kintner said that the Government used 1,000 sets of his special apparatus and that he got paid for three. Now, as to that special apparatus it is not up to the Navy to decide the legal claims, and I would like to ask if there is any commercial company which is using the apparatus as it was developed by Mr. Kintner? I understand that case is to be reached in court in the very near future. But we now obtain apparatus which does the same thing from another company, and which does it in a very much more practical way, and which is used by all other companies.

In other words, we are keeping up with the times. We use that apparatus, which was submitted by the De Forest Co. Whether or not it infringes the Fessenden invention we do not know. It is not up to us to know. We do know it is a much more practical piece of apparatus, from our point of view, and is used by the other companies. When the question has been settled by the courts, then we will know what to do about the other 997.

The point was brought out that in my testimony I stated the Federal Co. was the only company using continuous oscillations, whereas I should have included Sayville and Tuckerton. That is perfectly correct. I stand corrected on that point.

Mr. Kintner said—I do not recall his exact words, but he gave the impression—that his company was the first company to develop the

apparatus used at these high-powered stations. We do not know about that. The Federal Co. was the first company which supplied to us commercial arc transmitters or continuous-wave transmitters. They were submitted and they worked, and for that reason we have been using their apparatus since, although the Fessenden Co. has claimed we were infringing their patents. We may be; we do not know. But we get apparatus which works, and we got it from the only company which has shown they could deliver apparatus of that sort.

Mr. EDMONDS. How do you buy this apparatus—with a bond or guaranty against infringement suits?

Mr. CLARK. Yes, sir. The contractor holds the Government clear from any suits which may be brought.

Mr. EDMONDS. In case it is decided there is an infringement, then it is between the contractor and the owner of the patent?

Mr. CLARK. Yes, sir.

Mr. HARDY. Just one minute. That bond can be availed of by the patentee whose rights are infringed, can it not; that is, he can be subrogated to the Government's rights, can he not, or do you know?

Mr. CLARK. That is a legal matter about which I do not know. Commander Todd can answer that.

Mr. HARDY. Then, as I understand, you claim for the Navy, when you find a good thing, it is your duty to buy it and to make a contract with a bond guaranteeing you against any claims which might be sustained in the Court of Claims or any other court for infringement of the patent?

Mr. CLARK. That is what I understand, sir, to be the case. I know such a bond is required, and I have always understood that is the practice—that they could make use of it.

Mr. HARDY. What I want to know is what complaint anybody can have who is protected by that bond which would be, under the law (at least, as I understand), a protection to the patentee also because he would be subrogated under the bond.

Mr. CLARK. We understand their rights were assured under that bond. We want to be fair to every one, but our chief interest is to get the best for the Navy.

Mr. HARDY. You understand the Government itself has a right to use a patented process which it protects?

Mr. CLARK. Yes, sir; and we consider the legal machinery at the present time is sufficient for the patentee to obtain his rights in other ways rather than for us to pass on the question.

Mr. HARDY. And especially rather than have to wait until the courts had, after long years, finally decided on the various claims?

Mr. CLARK. That would be a peace-at-any-price proposition, I think.

Mr. HADLEY. But that would force the patentee into the position of obtaining his rights by subrogation in the courts, whereas presumably he has been protected by the Government's granting his patent without having to resort to a legal remedy in some law suit involuntarily forced upon him. I just want to make that observation in connection with the legal problem Judge Hardy presented.

Mr. HARDY. But that would be a case, as I understand from you, of what the law ought to be, whereas if the Government authorizes

its own department to use patented inventions under the system he speaks of, then the patent itself is granted subject to that law.

Mr. HADLEY. Yes.

Mr. CLARK. A number of inconsistencies in the Government's testimony were pointed out by Mr. Hogan and they are all due to looking to different sides of the same question, looking at it narrowly. A few cases can be cited, but I shall not take up any time because I do not think it amounts to much. Lieut. Commander Hooper said the Navy was slow to adopt new ideas. In my testimony I said the Navy always took what was best. I was referring to the purchase of apparatus as just outlined. Lieut. Commander Hooper referred to the adoption of a new, general, broad system which would involve the scrapping or throwing away of everything we have now.

I also said in my testimony the work of the Navy was open to all engineers and companies that wished to see what was being done: whereas Commander Todd said the United States kept secret what was being done. Again there is the same difference; I was referring actually to the practical manufacturing changes we had made in modifying apparatus to meet the particular naval uses. We of course want the companies to know every single thing we are doing in that line so that they will come up to that standard. We feel it is the highest standard. Commander Todd was referring again to the military problems, to the development of apparatus or methods which were not useful to the commercial people but were purely military.

As to the question of the *Salem*—the *Salem* undoubtedly was sent out primarily to carry out the acceptance test for the Arlington station which the Navy said would be done. But another reason for sending it out, one of the chief reasons we had to give in order to get the use of the ship, was to test the arc as against the spark apparatus. The two reasons were coincident; and even if it had been sent out only for the acceptance test, that in itself involved a large amount of money and I doubt if any commercial company would have done so. We obtained very valuable data merely from the test for the Arlington plant, leaving the arc set entirely out of the case, and that data was well worth sending the ship out.

The CHAIRMAN. You made that the occasion of testing the two systems—the arc and the spark?

Mr. CLARK. Yes, sir; we took advantage of the fact we were sending out the ship and combined the two tests.

The statement has been made that 1,000 members of the Institute of Radio Engineers would practically go out of business or something like that in case the Navy took over the control of the shore stations. I hope they won't. We have had the greatest cooperation from the Institute of Radio Engineers. In fact, I am willing to say I do not think we could get along without it in a great many ways; but I certainly think it will not go out of business.

The CHAIRMAN. It is profitable to them?

Mr. CLARK. The institute as an institute is an aggregation of radio engineers who formed that aggregation for reasons other than profit—for their love of the art.

The CHAIRMAN. What do they mean when they say they would go out of business?

Mr. CLARK. I understood the idea was they would lose interest in the development of radio because the Government would stifle development. But we certainly do not agree with that. The Government has been a factor in radio for a long time and has been the chief user of it, but development has gone on in spite of that fact.

Mr. EDMONDS. What reason did they advance for stating they would go out of business? Would there be any business for them to engage in if we took all of the stations away from them and put them into the Navy Department, and why should they stay in business if there was no means for them to engage in commerce?

Mr. CLARK. They are the source from which we obtain the apparatus, and we would have to obtain it just as we had before—from the commercial companies.

Mr. EDMONDS. But certainly, if you communicated with the ships only and the vast majority of them to-day experiment along lines of developing commercial companies, they would certainly go out of business if there were no commercial companies with which they could deal. You would not deal with them.

Mr. CLARK. We would still need to develop apparatus. Since apparatus must be used in a station we would be using that apparatus instead of the commercial companies.

Mr. EDMONDS. The Institute of Radio Engineers certainly will not have 1,000 members if the Government takes over these stations.

Mr. CLARK. It would be a sad blow to us if that occurs. But if we look at the Yearbook of the institute for 1916, I will call your attention to one thing that of the officers of the institute 30 per cent are now in Government employ; of the fellows of the institute, the highest members, 30 per cent are similarly so employed; and of the members 25 per cent are in the Government employ at the present time. So we at least won't have 1,000 drop out; we will limit that number to 750.

Mr. HARDY. If I can get your meaning clear in this little controversy it is that the same kind of apparatus would be used whether it was in the employ of the Government or in the employ of private companies.

Mr. CLARK. I certainly think so, sir.

Mr. HARDY. With the same necessity for the use of inventions and for improvement and the necessity to supply the same amount of trade, although under a different ownership?

Mr. CLARK. Yes; I think so. And I think it might be stimulated even more so in that the Government has to get the best inventions to keep ahead of foreign countries. The commercial people do not.

Mr. HARDY. I understand you to say the commercial people now employ the members of this institute and you do not think this 1,000 members would go out of business just because the companies would be operated by different owners?

Mr. CLARK. I certainly do not, sir. They develop apparatus and methods, and this apparatus and those methods will still continue to be employed.

Mr. HARDY. And to be bought from the inventors and developers?

Mr. CLARK. As they are now, sir.

Mr. EDMONDS. You remarked particularly in your previous hearing that the present duplication of apparatus was useless, and yet you say there would be just as many stations as you have now.

Mr. CLARK. You would not prefer to have a duplication of the apparatus unnecessarily in order to maintain these companies?

Mr. EDMONDS. I have always been taught that competition was the life of trade and I have always been taught that Government ownership stifles competition.

Mr. HARDY. And yet there is a question as to whether or not in railroad building and the building of public roads duplication ought not to be forbidden by law, and as it gets closer to civilization it becomes more and more necessary to prevent useless waste.

Mr. EDMONDS. Speaking for the people of Philadelphia we would be very glad indeed if the railroads were duplicated.

Mr. HARDY. Yes; and speaking for the people of my home town we have had a duplicate system of telephones there and it has been a nuisance.

Mr. GREENE. At the opening of your remarks, as I understood it, you said that this proposition to take over the commercial stations, which it was proposed to destroy, would be an inducement to those opposed to the bill in that they would have an opportunity to furnish new apparatus. What was the purpose of that statement? Or have I correctly understood what you said at the opening? Was that rather a holding out to the people who opposed the bill of an inducement for them to let you get the control?

Mr. CLARK. It was not in any way a bribe; but nevertheless as to the point you make, the apparatus of a number of those high-powered stations, which are not under consideration in this bill, is by no means of a very highly technical order. I do not wish to go into particularities, but a number of the stations contain apparatus which is little better than scrap iron.

Mr. GREENE. Then if you took possession of them, according to your theory, you would take them for scrap-iron prices and practically ruin the commercial owners by taking them for scrap-iron prices. That is what I want to get at. Then, as I understand, you make no provision in this bill for taking over the materials excepting at such figure as you might think they were worth; and you would ruthlessly take them over and then say to the men in business supplying apparatus, "Gentlemen, we are about to scrap all of this old apparatus, and then to buy new apparatus, and we will buy enough to make up for it, and we will furnish you with new business if you will only consent to our taking over all of these stations under our own control." Is not that what you said at the opening?

Mr. CLARK. What I said referred to the technical side only—that is, only the apparatus in the station would be better if obtained by the Navy.

Mr. GREENE. Of course you get your view according to the training you have had. But what I want to know is if you are not going to take these stations over and pay nothing for them and scrap them—if it isn't sort of a two-edged sword? Are you going to offer enough opportunity to the men who have the brains and skill to devise apparatus and say, "Why, gentlemen, you are going to get more trade out of this by reason of the fact that these properties will be scrapped and new apparatus installed?" That is the way I understood you. Of course, I have put it a little more bluntly than you did, but that is as I understood it.

The CHAIRMAN. If we just had one concrete case of where the Government ever got anything for nothing, we might have cause to lose some sleep.

Mr. GREENE. I do not think the Government ever gets anything for nothing.

The CHAIRMAN. If we just had one concrete proposition of that sort we might worry about it. I imagine if the Government takes over these stations—if it ever does—it will have to pay about three times as much as they are worth; they will never get them for scrap-iron prices.

Mr. GREENE. There is not any provision in this bill that protects those people; that is the point.

The CHAIRMAN. We are impeaching ourselves, you know, in making a suggestion of that sort. Proceed, Mr. Clark.

Mr. CLARK. A strong point has been raised as to the disadvantage of having naval officers in charge of the administration of shore stations, in that they serve for a limited time only. That is a point of view which is very common in commercial lines in regard to the general policy of the Navy Department as to the rotation of officers. And I am frank to say that for a great many years I agreed that was the case. I have learned differently from my intimate observation of the way this thing works out. The officer in charge does not have the control or the ability to make or break the Government's policy. Neither do I think that the president of any wireless company as it now exists has that ability. The system for carrying on the work was there before he came and it is going to be there after he leaves. The corps of clerks and other men in charge of the work, and the technical men who are engaged in assisting him and aiding him in technical matters, were there before he came, and they will continue to be there after he goes.

For that reason I consider now that the system is admirable and that the officer brings his own new ideas which are good, and he adds to the level which already existed. On the other hand, I have found that it is impossible, practically, for the officer to work any considerable harm to the system since it is too large and too well established. I think that rotation is extremely good, because it means new blood and new ideas and each officer leaves his impress on the situation.

If you will take a few moments to look over the field as I have seen it. I have been with the Government ever since it began to use wireless to any extent. The first officer under whom I served was Lieut. Sweet. Wireless in those days was just beginning. He saw the necessity for obtaining small field sets for shore work and short-distance work. That is something the Navy did not have. He went into this matter extensively and a number of sets were made for trial aboard ship. They were tried out under service conditions; in fact when Lieut Sweet went to sea soon afterwards he took the first sets with him. They were also tested by other officers and proved to be admirable, although they would only work for a short distance. To-day we have a very large number of those sets and they are now considered to be essential to our work.

He was succeeded by Commander Todd. Commander Todd is responsible for inaugurating the modern quenched spark transmitters,

and he also was the one under whom the first high-power station was inaugurated.

Mr. Hepburn succeeded him and he at once undertook the extension of the engineering system. Under his administration a number of civilian engineers were appointed and the system adopted of dividing the technical work among the various navy yards. Also under his control there was established a semimonthly bulletin on the progress of each yard, which was distributed among the yards and among the ships, and which in the run of the year contains a great deal more information than is contained in the yearly issue of Institute of Radio Engineers, although a great deal of it is along confidential lines.

Since Mr. Hooper came in he has greatly systematized the methods of handling business and has reduced the cost of doing business and the time taken to carry on the purely business side of the Navy; that is, the purchase of apparatus, correspondence, etc. The system which he has organized is now running along automatically and there is no question whatever but that it will continue to do so after he leaves.

All the good points which the previous officers have established will be used exactly as they were when their sponsors brought them forth, and some have grown still more. I do not think there is any need whatever to fear the practice of assigning these officers every three years will ever cause the system to be less efficient.

Mr. HARDY. As I understand you, you think that the continuance of one set of employees begets a system of ruts and these changes enable you to retain all of the best suggestions of the old officers and to improve with the new ideas of the new men?

Mr. CLARK. Yes, sir; as far as the broader policies are concerned. I do not think we should have clerical changes every so often, because there must be a system on which this control is superimposed so that the system will continue.

Mr. RODENBERG. Do you have very many resignations in the Government service of men going into these commercial companies?

Mr. CLARK. One of our best men, who, although not at the time rated as radio aid, was actually engaged in radio work, resigned some years ago. None of the radio aides have resigned.

Mr. RODENBERG. None?

Mr. CLARK. No, sir. We have obtained these men from the commercial companies; some of the very best men which they had; men who knew the business from a practical point of view before they came with us, and we have been very glad we adopted that policy. It has certainly worked wonders from our point of view. They brought the practical knowledge which they had obtained with the commercial companies to our service and have been responsible for the principal advances to which I referred previously.

Mr. EDMONDS. That is not true of the operators, is it?

Mr. CLARK. No, sir; not to such an extent.

Mr. EDMONDS. They go to the commercial companies?

Mr. CLARK. They serve for a definite time, which they may extend or not, as they please. As a rule, both yes and no can be given in answer to the question. A large number remain with the service for a long time and progressively advance through various grades until they become officers. We have now a large number of warrant

officers who are the product of the Navy routine who are excellent men. They compare very favorably with men of the same grade in commercial lines.

Mr. EDMONDS. You mean operators who were enlisted men and then were advanced to the grade of warrant officers?

Mr. CLARK. Yes, sir; known as radio gunners, and those men are very practical.

Mr. EDMONDS. They are still employed in the operating business when they become officers?

Mr. CLARK. They make the link between the operating side and the purely administrative side of the commissioned officers. They form a very desirable and important link between the two.

Mr. EDMONDS. What do they do on the ship?

Mr. CLARK. Their work is to be in charge of the routine and detail technical work.

Mr. EDMONDS. They have operators under them?

Mr. CLARK. They have operators under them. They do not stand watch. The operators do the actual work and the gunners are responsible for keeping the apparatus in working order and can do it.

Mr. EDMONDS. And that is true, of course, of the shore stations.

Mr. CLARK. That is true of the shore stations.

Mr. EDMONDS. You have them in charge of the shore stations, the same as on shipboard?

Mr. CLARK. Yes, sir; at all the high-power stations we have a number of men and at all the important coastal stations.

Mr. EDMONDS. Don't you find a number of operators leave you because they find the commercial people pay better wages?

Mr. CLARK. Yes, sir; with the operators we find that the case.

Mr. RODENBERG. That is what I had in mind when I asked if it was not a fact your men left you to go with the commercial companies.

Mr. CLARK. A number of them are not temperamentally fitted for working under discipline, but I am perfectly willing to say that the higher grade of operator is the one who stays with us, and I hope it will continue to be that way.

I now come to a very important feature and that is the young inventor, and I hope I may make myself clear when I say we try to deal as fairly as we can with those young inventors. The case of greatest importance is the case of Mr. Armstrong. The matter of Mr. Armstrong's patent is one that is fully as complicated as any problems we have had to deal with in patent rights, as I will show you from a telegram from Lieut. Hooper. I am sorry that this is the case. I want to call your attention to the fact that Mr. Armstrong is a protégé of Prof. Pupin, having studied under him, and I think he now holds a position as professor under Prof. Pupin. I am rather inclined to think the professor would have liked to see Mr. Armstrong get as much money from his patent as Prof. Pupin got from the telephone company for his patent. But, unfortunately, the Navy has not as much money as the telephone company.

Now this question of royalty comes up. We buy a considerable number of receivers from the Marconi Co. They contain what Mr. Armstrong claims to be his patent. He already gets royalties from the Marconi Co., I understand. So that in that case I do not see

why he should ask royalties from the Government for apparatus which has been delivered to it by the Marconi Co.

We also buy receivers from De Forest. De Forest claims that the apparatus he supplies to the Navy does not infringe the Armstrong patent. It is not up to us to say. The matter has never been tested out in the court that we know of.

Let me read this telegram from Lieut. Hooper:

Replying telegram department contract with Atlantic Communication Co. includes the provision licensing the Navy Department use coupleback circuit which Atlantic Co. claims antedates Armstrong patent.

In other words, we have a contract with that company by which we have the right to use a type of circuit which the Atlantic Communication Co. claims antedates the Armstrong patent. It is not for us to say. He says further:

Final decision as to rightful owner patent not yet adjudicated. The Navy also has some claim along this line. I originally brought to Armstrong's attention fact Navy using his circuit and suggested that he take steps clarify situation in order to secure recompensation, if his claim deserving.

That puts very clearly the point I have been trying to bring out—that after the matter is settled and we know who owns the patent, we are perfectly willing and glad to pay them, and will do so.

Armstrong then asked impossible amount. After explaining Government's position and estimate of value this invention as compared with other apparatus, we held conference with solicitor and suggested three forms of contracts which might be entered into on satisfactory basis. Armstrong left apparently satisfied, stating would have lawyer draw up contracts and return. Never came back, but lawyer called after long lapse with entirely new impossible proposal, and matter was left open. Believe tentative suggestion seven or ten thousand made, but way left open further negotiations. Government's position is briefly already has license; Armstrong's patent not proved. Latter asked unreasonable amount, considering value apparatus, and therefore could not be fooled with, and must go Court of Claims or be reasonable. Also, way was left open to him further negotiations.

Mr. EDMONDS. I can not understand why the Government is negotiating with Armstrong, in view of what you told us a short time ago, that when you buy this apparatus you are protected by a bond. What interest has the Government in Armstrong's patent if when you buy these things from the De Forest Co. they have to protect themselves and the Government in the bond they furnish?

Mr. CLARK. The point is well taken, sir. The intention was not to make use of this patent in any apparatus which we obtained from other people, but, as Dr. Cohen testified, we bought from him the right to manufacture a new receiver, which we are now manufacturing at the Washington Navy Yard, and of which we have several hundred in service. In that receiver we embody several features which Mr. Armstrong claims in his patent. It was to make use of it in our receiver, to be fair, that we took the question up with Mr. Armstrong; not for any legal reason, but as a general proposition for fair play.

Mr. EDMONDS. You are using something that may be an infringement of his patent in this receiver?

Mr. CLARK. Yes, sir.

Mr. EDMONDS. And Armstrong has not proceeded against you for doing that?

Mr. CLARK. No, sir.

Mr. EDMONDS. And that is not a matter covered by the De Forest bond?

Mr. CLARK. No, sir.

Mr. HARDY. Just one minute, Mr. Chairman. I do not see that this committee has any province in the settlement of the claim of Mr. Armstrong, whatever claim he might have, and certainly having heard a reasonable amount of testimony in our hearings from each side, I think we might just as well eliminate that, because I do not think we can do anything about it, anyhow.

Mr. EDMONDS. I do not think it should be gone into, except the question has been raised here and Mr. Armstrong has made certain statements. And now they are being refuted by the department, and I wanted to get the thing clearly in the record, because, as I understand Mr. Armstrong's testimony, it is the De Forest machines which are causing the trouble. Now, the Government, so far as the De Forest machines are concerned, is absolutely protected; but if they are going to use Mr. Armstrong's invention on the side and put it into some new appliance, that is something else; and, of course, if they are doing something which is supposed to be an infringement, then, of course, the Government is open to suit in the Court of Claims.

Mr. HARDY. The reason I make this suggestion is to save time. It seems to me we have gone sufficiently far into it.

The CHAIRMAN. These gentlemen have emphasized the fact that the Government has treated them very harshly in the matter and emphasized the Armstrong case as a typical case, and Mr. Kintner himself was especially severe in his criticism of the Government, saying they had only paid him for three of his instruments, whatever they were, and owed him for a thousand more, perhaps; I do not know how many more.

Mr. HARDY. I understand the other side have put in much more testimony.

The CHAIRMAN. Now, Congress comes in for blame again in that the legislation of 1910 expressly provided the Government should not be harassed by injunction suits, and it might take over and utilize these inventions and refer the contesting claimants to the courts for a settlement of their claims. Now, in the beginning, when our patent laws were first enacted, the Government might easily have provided that it could use these inventions without any question of its right to do so for governmental purposes.

Mr. HARDY. The point to my mind is, I am so well satisfied with the wisdom of the law of Congress that I do not care to take any more time.

The CHAIRMAN. I do not, so far as I am concerned; but I want an explanation, because if there was any real harshness or oppression toward this very worthy young man I wanted to know what it was. That is the way I feel about it.

Mr. HARDY. I have no further objection to make to it.

Mr. EDMONDS. I only wanted to bring it out, because I wanted it plainly stated in here it was not the machines the De Forest Co. were making which were responsible for it, but it was the machines they were making themselves.

Mr. CLARK. I have one other case to bring out, the case of Mr. Chambers. I have received a report from Mr. Forbes, in charge

of the radio work at the Philadelphia Navy Yard, as to this invention of Mr. Chambers. He had a very ingenious scheme. It is one of the many modifications of the audion detector. For the benefit of any technical man present who may not know what his invention is it consisted simply in connecting a wire from the antennæ over to one element of the audion detector. I have no doubt whatever that it made the receiver, as a whole, more sensitive, as he claims it did, but it also does another thing. It has been proven by experiments, for we have tried this experiment ourselves, that it brings in static interference very much more than the ordinary circuit, and for that reason Mr. Forbes reported that the sort of connection Mr. Chambers used was not desirable, and hence he did not communicate any further with Mr. Chambers. It was not because we wished to discourage him in any way, but because, unfortunately, it did not offer any material advantages.

A small point that may be brought out with reference to the hostility of the Institute of Radio Engineers is shown by the resolution which they passed. I happened to be present at one of the meetings, and I want to call your attention to the fact that a number of Marconi men were members of the committee which framed the resolution; and it is only fair to assume they were safeguarding their own interests rather than those of anyone else. For that reason I think we might consider the resolution of the Institute of Radio Engineers as being the act of the Marconi men present.

Mr. EDMONDS. I think they were mighty good politicians if they marshaled the 30 per cent of the Government employees.

Mr. CLARK. I do not think 30 per cent of the members of that special committee were naval men.

The CHAIRMAN. Who composed that special committee?

Mr. CLARK. I have not the names here, but they can be inserted.

Mr. SARNOFF. I can give them now, if you would like to have them, Mr. Chairman.

The CHAIRMAN. We will have them at the proper time.

Mr. ROWE. I would like to ask a question or two. When you were on the stand before did you not testify you thought the private companies would like to sell out?

Mr. CLARK. I probably did; yes, sir.

Mr. ROWE. And did not nearly all the proponents for this bill so testify—Commander Todd and others?

Mr. CLARK. I do not know. I have not read their testimony.

Mr. ROWE. You were here, though, were you not?

Mr. CLARK. I do not recall that statement.

Mr. ROWE. What do you think now? You have been here practically all through the hearings, have you not?

Mr. CLARK. Yes, sir.

Mr. ROWE. What do you think now about the private corporations being anxious to sell out?

Mr. CLARK. They certainly do not seem to be anxious to sell out, but I think very possibly the reason for that may be brought out a little later. I do not think they are anxious to stay in control of the stations on account of the direct revenue they obtain from those stations.

Mr. GREENE. They might want a little experience.

Mr. CLARK. Yes, sir.

Mr. ROWE. How about the indirect revenue of the Marconi people? For instance, they are large manufacturers?

Mr. CLARK. Yes.

Mr. ROWE. And they equip most of the commercial vessels, do they not?

Mr. CLARK. Yes, sir.

Mr. ROWE. And how about the indirect profit that comes from that?

Mr. CLARK. That would be in no way hindered, as far as I can see, by the passage of this bill. They would still equip the ship stations and would do so under more fair competition.

Mr. ROWE. If you were in a commercial business or interested in the Marconi Co., and a bill like this came along, and then you heard afterwards that the bill was not satisfactory to the Government, and that the Government claimed it should take over all the stations, do you not think you would be worried about the question of whether or not a little later on they would not want to take over the equipping of all the vessels also?

Mr. CLARK. Yes, sir; I should certainly be worried about it.

Mr. ROWE. I certainly should myself. That is all.

Mr. EDMONDS. Do you not think the proponents of the bill made that statement, that they would all be anxious to sell out, with the idea that if this bill passes, they all would be anxious to sell out?

Mr. CLARK. I do not know. I wish to confine my answers to the technical and practical questions and not attempt to answer legal questions.

The CHAIRMAN. I believe they all stated their shore stations were not profitable.

Is there anything further?

Mr. CLARK. I have nothing further to say, sir.

SUPPLEMENTAL STATEMENT OF COMMANDER DAVID W. TODD, UNITED STATES NAVY.

Commander TODD. Mr. Chairman and gentlemen, in concluding our statements I wish that we could talk only about the broader features of this important matter, only of the reasons which have impelled so great a part of the executive branch of the Government to stand behind this bill, and could say right out that while these commercial companies that expect by patents or operation or some other means to get control of the whole situation do not want to sell their stations and divert some of their capital to other lines and to open the market to more competition in the business of equipping ships, the national necessity is paramount and no argument is necessary. Of course the companies opposing this bill do not want to be on record before their stockholders as being in favor of selling out, and if they did want to sell their stations, it would not be policy for them to say so here openly before the committee. So they have gone to great lengths in opposing the bill, because the note of Government ownership has been very firmly struck, and to some of them at least it is a matter of existing or not existing, or existing in certain fields only, when they propose to exist in all fields and have a monopoly.

There are various reasons for wanting a monopoly. The principal one is that there is no money to be made in a great part of this business except by a monopoly. The control of the shore end of the communications means the ability to tell the steamship companies, "You must equip with our apparatus or you will not get service. The present law does allow the Government to handle commercial business at certain places, but those places are not of very great consequence. What you want is communication when you get near the greater ports—New York, Philadelphia, and Boston. We are the only ones who can supply that; therefore you must equip your ships with our apparatus."

The following extract from the hearing before the subcommittee of the Committee on Commerce, United States Senate, dated March 1, 1912, shows the relation of shore stations to ships operated by the same company (p. 86):

The CHAIRMAN. They could confine their activities to your stations?

Mr. MARSHALL (representing the United Wireless Co.). Yes, sir.

Mr. BOTTOMLEY (vice president Marconi Co.). It would be a good thing for me to go out of the shore business and do nothing but equip ships and go and use the stations without any expense whatsoever. The subsidies that we require from the ship owners now help to support the shore stations.

Mr. MARSHALL. If the Government handled all the shore-station business, we would all then be on the same basis.

Mr. BOTTOMLEY. There would be no necessity for that clause if the Berlin treaty passes.

The CHAIRMAN. There is no necessity for this, in your judgment?

Mr. BOTTOMLEY. Not if the Berellin conference is ratified.

Senator BURTON. How would you cure that situation in regard to the shore stations? You say that they are worked at a loss and yet that the rate of 12 cents is as high as you can charge. Do you propose any remedy for that?

Mr. MARSHALL. The remedy may be found in foreign countries.

Senator BURTON. Your delegates go to the next conference and advise, and if it bears heavily on any of the investors, it is a thing for consideration?

Mr. MARSHALL. The remedy in foreign countries is that the foreign Governments operate the shore stations.

The CHAIRMAN. All of them?

Mr. MARSHALL. Practically all of them.

The proponents of the bill can not assume that the committee will consider the arguments of the opposition futile and beside the point; we have got to go into past history to show the reasons which impelled these various companies to oppose the bill, in addition to the reasons they gave, and to defend ourselves in view of criticisms contained in certain statements they have made. Any point not covered is considered of too little importance or too easily answered to spend time on, but we are prepared to explain fully our attitude on any point.

I invite your attention to the fact that any Government activity, any department, bureau, or office, or even Congress itself, is peculiarly open to criticism. The press is free to attack statements, or motives, or anything else. So, in what I am going to say now, I want it to be understood that my statements can be substantiated by papers or persons, with very few exceptions, which I hope to word in such a way as to show that they are matters of personal opinion. This need not apply necessarily, however, to questions by members; because, as I said before, each part of this matter is so intricate, so mixed up with other items, that I could say "yes" when many of those sitting around here will say that I should have said "no"; "yes" and "no" being an answer to the question, depending on the

point of view. I think that the committee has had a chance to notice that in some of the testimony that has been taken. Being on the side lines I have noticed the questions of a member, have conceived what was in his mind, but the witness, carrying in mind the thought he was trying to bring out in his statement, has answered directly the opposite of what he should have done. Furthermore, I found several places in my own testimony where that occurred, have corrected my testimony, and have changed "yes" to "no."

I shall speak now of the Marconi and the National Electric Signaling Co. They are the principal opponents of this bill and to any radio legislation.

The CHAIRMAN. They were here scrapping before.

Mr. TODD. The hearings before this committee and before the subcommittee of the Senate on the last bill are filled with denunciations of almost any form of regulations.

The following extracts illustrate this. They are from the printed "hearing before the subcommittee of the Committee on Commerce United States senate," dated March 1, 1912 (p. 14):

The CHAIRMAN. Have any of you gentlemen representing various companies objection to this section, namely, the licensing of companies or individuals operating any wireless telegraph?

Mr. KINTNER. Yes, sir. We object to that, believing that a license, as that regulation is explained here, implies a right upon the part of the department to issue or refuse a license upon application as they may see fit.

Page 15:

Mr. KINTNER. We would be perfectly willing to register and file with the department a register of every station, giving a complete description of the apparatus employed and any special data that they might desire to be filed for any reference they might desire to make of it.

Page 16:

The CHAIRMAN. Is it a manufacturing company of apparatus, or is it an operating company?

Mr. KINTNER. We have never carried on any commercial operations as yet, but it is our expectation to do so.

The CHAIRMAN. Now, returning to this license feature. You are opposed to the license, but you are in favor of filing such information as the department may require in the way of the scope of your activities?

Mr. KINTNER. Yes, sir.

The CHAIRMAN. Are any of the other gentlemen present opposed to the licensing feature?

Mr. BOTTOMLEY. We are opposed to the licensing feature, because it is absolutely unnecessary, in our opinion. Whatever information is required by the department we will be glad to give. Heretofore we have given them all the information they wanted.

Page 18:

Mr. BOTTOMLEY. There is no reason why we should be hampered by these governmental restrictions that I can see. There is no advantage to be gained.

Senator BURTON. There is no danger due to interference, or anything of that kind?

Mr. BOTTOMLEY. Interference in what way?

Senator BURTON. Interference in the transmission of messages.

Mr. BOTTOMLEY. We have had no trouble whatsoever with regard to interference. We are engaged in work in the city of New York—probably the most congested city in the country, and possibly in the world. We have had no trouble in that respect whatsoever. Our operators are able to take their messages when the navy-yard wireless is working and when the United is working. We have had no trouble. The interference, in my opinion, is caused by the inefficiency of the operators who are working in the Navy.

The CHAIRMAN. Then you are bitterly opposed to the adoption of the licensing feature?

Mr. BOTTOMLEY. We are bitterly opposed to the adoption of any bill which hinders our work and this licensing feature is one we object to.

Page 19:

Senator SMITH. Have you any rules or regulations or policy which prevent you from interchanging your wireless messages with ships or stations equipped with devices other than Marconi?

Mr. BOTTOMLEY. We have no rule in that respect. We would not interchange except on ships. We have always interchanged with ships, but not with land stations.

Senator SMITH. On ships you do interchange?

Mr. BOTTOMLEY. Yes, sir. And all our stations are open to all Government work. Every Government ship can come in and use our stations whenever they feel like it.

Senator SMITH. I think it was developed before the Committee on Foreign Relations that that was one of the complaints made against your company—that you refused to interchange with other companies.

Mr. BOTTOMLEY. We do not interchange commercial business with corporations which are not using the Marconi apparatus, which corporations we claim are infringers. We do not communicate with them because it might vitiate our patents. We are so advised by our attorneys.

Page 36:

Mr. BOTTOMLEY. Page 3, the first line. It says: "License shall be issued only to citizens of the United States."

There is no reason that I can see why aliens should not be just as good operators as any other persons. In fact, many of them are better.

The CHAIRMAN. I assume that that is put in from a protective standpoint. We might have more loyalty among American citizens than among foreigners.

Mr. BOTTOMLEY. Loyalty to what? Loyalty does not come in. That is a mere matter of operation. Laws permit every alien to come in and enter into any business he likes. I do not see why a man should be prohibited from obtaining a license simply because he is a foreigner.

The CHAIRMAN. What is the reason for that, Commander Todd?

Mr. TODD. To keep aliens out of shore stations in the United States.

The CHAIRMAN. In time of war or threatened war?

Mr. TODD. With that in view.

Mr. BOTTOMLEY. In time of war that would be all right, but in time of peace he is not doing any harm.

Mr. TODD. Otherwise the agent of any foreign Government could put up a station at any place he wished. There is no restriction whatever. If only American citizens or companies can put up stations and if they have to man these stations by American citizens the chances of wrong being done are eliminated. A station put up by an agent of a foreign Government and manned by foreign operators might send messages across the ocean inimical to the United States Government.

Mr. BOTTOMLEY. That is so far-fetched as to amount to nothing at all. That is impossible.

Mr. TODD. It refers to shore stations only. The Marconi Co. is an American company and there is no necessity for the employment of foreign operators in its shore stations. On board ship, operators of any nationality may be employed.

Page 50:

Mr. KINTNER. I would suggest its elimination, as section 7 covers the same thing. I think no ship should be restricted in sending a distress signal.

Mr. BOTTOMLEY. I agree with you in regard to that. A ship ought to be allowed to send out any waves on any wave length whatsoever. An operator on a sinking ship should not be required to look around for a wave length.

Page 60:

Mr. BOTTOMLEY. This would be a very dangerous provision to be put in. It would stop our business.

Page 66:

The CHAIRMAN. As I understand it, all you gentlemen are opposed to sections 12 and 13?

Mr. BOTTOMLEY. Absolutely.

Page 67:

The CHAIRMAN. I will now read section 14. * * * I understand you are all opposed to that?

Mr. BOTTOMLEY. Yes, sir. That has been fully discussed.

The CHAIRMAN. I am going on with section 15 now. * * * Your objection to that lies the same as to section 14, because they both go together?

Mr. BOTTOMLEY. Yes, sir.

Page 74:

Senator BURTON. Does anybody here object to that?

Mr. BOTTOMLEY. I think you are raising a very good point. At some future time we may have some very great improvements which we might be unable to test out or set up in the city of New York, for instance. To be dependent upon the Secretary of Commerce and Labor would be very objectionable to any commercial organization. We want to have certain rights to do things without asking. I think that nineteenth clause should be stricken out.

Mr. KINTNER. Senator Burton has described the conditions of our company almost exactly. Our company has been in the wireless business since 1902, actively engaged in developing apparatus. Up until recently we have not felt warranted in undertaking the erection and equipping of many stations, owing to conditions in the field. We have erected a station in Boston, which is ready and is in operation, and we are now completing a station in New York, and these are but two of the set of stations that it is our intention to erect. This new law will keep us out of all the cities all along the coast.

Page 76:

Senator BURTON. Paragraph 19 is a pretty strong paragraph.

Mr. BOTTOMLEY. It is a very dangerous one to the commercial companies which may hereafter come along without some really good improvements.

Page 79:

The CHAIRMAN. We will take up section 5. Is there any objection to that?

Mr. BOTTOMLEY. Who is the "owner"? I object very much if the operator should misbehave and the owner be imprisoned for the fault of the operator.

Page 87:

Mr. BOTTOMLEY. I am taking the liberty of filing this paper.

The paper referred to is as follows:

"Mr. Chairman and gentlemen, the bill under consideration, to my mind, shows an earnest and sincere effort on the part of the introducer to provide a bill which would not be, in his opinion, adverse to the interest of the commercial workings of the established wireless companies; but looking closely into it further shows to me a very earnest purpose on behalf of the Army and Navy departments to provide a means for not only controlling but also of throttling the industry of wireless telegraphy as at present in course of exploitation and establishment, which control I verily believe is intended to be merely a stepping-stone to the projected ultimate acquisition by the Government departments of all wireless telegraphic operations, and on this account the bill has many pernicious features.

"In the very first instance I wish to place myself on record, on behalf of my company, the Marconi Wireless Telegraph Co. of America, as absolutely and irrevocably opposed to any governmental control so far as the actual working of wireless telegraph is concerned; to emphatically but respectfully assert that there is no just or proper reason for legislation which imposes restrictions on and impedes the proper and legitimate transaction of business in wireless telegraphy any more than there is reason for similar legislation which would offset and impede the commercial working of wire telegraphy or telephony."

They did not want to be regulated at all. They started out with the very first words of the bill and objected to having their stations licensed. Without license no control! They were willing to be "registered" or to furnish information about their stations, but they did not want to be licensed. They did not want any wave-length regulation. They claimed, generally—I am referring particularly to the Marconi Co. and the National Electric Signaling Co.—that they were getting along beautifully among themselves, and there was no need of regulation on account of interference at all. This "interference" was the invention of the Navy; which statement is extreme, if not fantastic.

The CHAIRMAN. I like to see people express their fears. They may be imaginary, but still if the proponents had a free hand there is no telling how far they would go. It is for the committee, after all, to weigh the pros and cons; but I always like to invite sharp criticism of all proposed legislation.

Mr. GREENE. I certainly think we ought to have criticism. We shall not learn anything if we sit down here and take one side and not the other. I think we ought to have it in a broad sense.

The CHAIRMAN. Oh, yes. Their fears were not realized so far as the existing legislation is concerned. We have had the same attitude taken on the legislation for the proposed Federal reserve act and all other proposed legislation. But it serves a wholesome purpose.

Commander TODD. The criticism has served a good purpose this time, because it gives me an opportunity to bring up a number of points that the committee should know. I am now engaged in that.

The companies mentioned were strongly opposed to the ratification of the Berlin convention. They took a positive attitude. They said that the convention was not up to date, not feasible and practicable in this country; that it would do harm, suppress the art—and various other things. I won't go over the argument at all; it is all in print. The Senate ratified the convention, the President approved it, it is now working beautifully, and we have been able to solve the difficulties connected with the land lines not owned by the Government and the cables. That is working splendidly; and when, later, the London convention—which made very few changes in the Berlin convention—came along it was also ratified by the Senate and approved. On this question of radio legislation in 1910—when we had none at all—if I am not mistaken, this committee unanimously recommended the passage of the bill in spite of the arguments of the Marconi Co. and the National Electric Signaling Co. The bill was lost on account of other legislation, the crowded condition of the calendar—lack of time.

In 1912 the subject was opened anew. There were extensive hearings, and everybody had a chance to say everything he pleased. The National Electric Signaling Co. and the Marconi Co. opposed the measure, almost in the same words any regulation; except, when they were brought down to it, they said, "Well, we might have a range of wave lengths for commercial and Government use; there are waves enough for all the commercial people, and the commercial people should not be hampered. We do not have any interference; we do not want regulation on that account; we are getting along splendidly. If you just leave us alone we will develop this art so that the question of interference will be eliminated." The National Electric Signaling Co., especially, claimed in 1910, and again in 1912, that they were just about to perfect a device which would cure all these (alleged) interferences. That was the heterodyne. The heterodyne is not to-day a practical instrument.

I invite the committee's attention to the following extract from the printed testimony of the hearing before the subcommittee of the Committee on Commerce of the Senate, dated March 1, 1912, pages 65-66:

Mr. KINTNER. It is by reason of a new device that is being perfected.

Senator SMITH. It has not yet come into general use?

Mr. KINTNER. No, sir.

Senator SMITH. Is that what you call the—

Mr. KINTNER. The Fessenden heterodyne system. We have other devices for preventing interference upon which we can cite reports made as far back as 1904, which show that we could prevent interference; that is, any wave length that was more than 3 per cent over the wave length you were trying to receive

could be received without any interference from stations very close by. Ten per cent would cut them all out.

Senator SMITH. Your contention is that if such a limitation as this is fixed the practicability of your new development will be interfered with and discouraged?

Mr. KINTNER. It will be discouraged. It will discourage development along those lines. We feel that this regulation is also unnecessary.

Senator SMITH. What do you say to that, Commander Todd?

Mr. TODD. I think that—

Senator SMITH. I was impressed with this the other day, and the reason I bring it out is because of this development of the other day.

The CHAIRMAN. In the Committee on Foreign Relations?

Senator SMITH. No; when you were not here. In this committee.

Mr. TODD. If the United Wireless Telegraph people were required to buy any such apparatus as that from the National Co. they would have to go out of business rather than attempt to buy it. The Navy will buy it if it does what it is claimed to do.

Senator SMITH. Somebody will buy it.

Mr. TODD. Yes, sir; somebody will buy it. The Navy will buy it, but I do not think the United Wireless Co. could afford to buy it.

The CHAIRMAN. What would be the cost?

Mr. KINTNER. I can not say right offhand. It would depend upon the quantity in which it is made. It is not anything that has an abnormal cost.

Senator BURTON. You have some suits pending relating to that device?

Mr. KINTNER. No, sir; that has never been infringed as yet.

Mr. TODD. This was promised four years ago by the same company and we have been waiting for it all these years, and we still have neither the interference preventer nor any regulations. We want one or the other right off.

The CHAIRMAN. You want performance, either by Congress or by the gentlemen who have the device?

Mr. TODD. That is, if he is going to settle it one way we want it.

Senator SMITH. It is a little dangerous to overcrowd genius.

Mr. BOTTOMLEY. We agree altogether with the National Signal Co.

Senator BURTON. This is taken care of in the bill.

The principle which Prof. Fessenden invented is a good one, and the principle is now used in the receivers which Mr. Clark spoke of—those that include the De Forest bulb (audion) and the Armstrong circuits. Whether or not Dr. De Forest's apparatus does, as far as patents are concerned, contain the idea as patented by Prof. Fessenden I do not know. I have no idea of that at all. That is a matter I will touch on briefly a little later. But the fact is the National Electric Signaling Co. has not, since they furnished the apparatus now used as a secondary high-power set in the Arlington Station and several other sets that may or may not be in use—I can not say positively—has not progressed with the development of that principle to the extent of getting it into common use. They may have been developing this heterodyne and it is still being developed. They are working on continuous-wave transmitters, but we have not yet a continuous-wave transmitter from them. In the meantime Dr. De Forest brings forth the receiving principle of the heterodyne or one similar to it in another form, entirely distinct; and the Federal Telegraph Co. has managed to show us that their Poulsen arc apparatus is a much simpler apparatus and does accomplish the same thing that the proposed National Electric Signaling Co.'s high-frequency generator does not do, as far as practical results are concerned—practical results that the Navy Department can take advantage of. If the committee will give me the time later I will show very clearly the difference between the arc and spark apparatus and the advantages of this arc installation that we have gone in for so largely.

When Mr. Marconi made his invention he took it to England; and the English, a maritime nation, promptly recognized its possibilities for their commerce and their fleet. They backed Mr. Marconi for all they were worth and practically made it an English apparatus—an English monopoly. They took steps to keep that monopoly in the hands of the Marconi Co. in order that the Marconi Co. could spread over the world, dominate the radio field, and the British Government would be able to have the advantages for her commerce and for her fleet of the latest developments.

The Germans commenced experimenting with this discovery, and I think that it can be shown very conclusively that they went right ahead of the Marconi Co. The Germans and other nations finding that the Marconi Co. was refusing to communicate with ships other than those of their own system, other than those equipped with the Marconi apparatus, proposed these international conferences, with the idea of coming to an international agreement to prevent this art being tied down by a private monopoly which had the British Government back of it. I suppose there were political reasons in there also; but in order that it could be developed under proper regulations for the use of all countries, on account of the signals traversing international boundaries and covering the high seas, its international regulation was said to be necessary.

There was a preliminary conference in Berlin and it was decided to hold a formal conference in Berlin in 1906. That conference was held, and the British representatives tried to have every feature favorable to the Marconi Co. incorporated in the convention which was drawn up. After the convention was signed, it had to be ratified by the participating nations, and Great Britain had to look at the matter squarely in the face and appointed a very distinguished committee, scientific men, practical men, naval officers, post-office men, and Marconi men. They debated the question of ratification at great length, and their conclusions are printed in a Senate document. They gave all of the reasons for and against ratifying the convention. It meant, practically, the end of universal monopoly by the Marconi Co. The convention, among other things, provided for intercommunication between ships and stations. The British delegates would not agree to that at all. A number of the other nations did sign a supplementary protocol, I think they call it, which included this feature, saying that intercommunication between ships and shore stations, irrespective of the systems employed, was necessary. So the British Government finally ratified it, and still our Government held off and did not ratify it until 1912; but having ratified the Berlin convention, the London convention, which was submitted in 1912, was promptly ratified.

The Marconi Co., with this British backing, of course, equipped the great trans-Atlantic lines, the White Star liners, and the Cunarders. They extended across the ocean and put up stations at strategic points near the approaches to New York; a station at South Wellfleet, Mass., on Cape Cod; a station at Siasconsett, on the island of Nantucket; the station at Sagaponak, on the shore of Long Island near the east end; and the station at Sea Gate, at the entrance of the New York Harbor. All are still working except Sagaponak. In that way the Marconi Co. undertakes to handle and

has been handling ever since all of the cream of the wireless trade; that is, working with the ships that carry the wealthy passengers, make frequent trips, and carry the greatest number of passengers. All these ships are equipped with Marconi apparatus, almost all under the British flag, and the Marconi Co. of America is an extension of that system to this side. They subsequently put up their stations elsewhere.

Mr. EDMONDS. Have you any idea how many shares the company in England owns in the company here?

Commander TODD. No, sir; I have no recent information on that point.

Mr. EDMONDS. Was that given in the testimony?

Commander TODD. No, sir. There is some indication of the value of the shares held in England, but that is wound up with other information which will come up later. We can not give the present figures, but we have ex-Attorney General Griggs's statement that a very large percentage of the shares are owned in the United States. I have some statements that indicate he may be referring to a special type of share, or something of which I will have to let the committee judge. There are printed documents of the Marconi Co., of England, which seem to indicate that that company has a considerable interest in Gen. Griggs's company.

Mr. HADLEY. Was not his general statement to the effect they owned about a third of the stock?

Commander TODD. I do not remember; but there was something like 18,000 shares owned in the United States out of 22,000.

Mr. FORD. Eighteen thousand stockholders.

Commander TODD. Oh, pardon me; 18,000 stockholders, not shares.

Mr. HADLEY. I am only speaking from my general recollection.

Commander TODD. I do not recollect. I had the idea that Gen. Griggs claimed that very little of that stock was owned abroad.

Mr. EDMONDS. Is the agreement of the parent company and the Marconi Co. of America a public document?

Commander TODD. No, sir. At least, I have not seen any; but reports of the British Marconi Co. clearly indicate the fact that the American company is a subsidiary of the British company.

The CHAIRMAN. Here is what Gen. Grigg said:

At the present time the American company has about 22,000 stockholders, of which 18,000 stockholders are residents of the United States. Mr. Marconi has been, during the existence of the company, an honorary vice president, but has never taken any part in the management of the company, which is an American corporation. * * * Mr. Marconi got for his American patents stock in the company. He got no money and he never has from the American company. In addition to the stock which they issued for patents, the public has subscribed for and taken about \$7,000,000 of the cash capital at par, which is the money contributed to the American Marconi Co., its total capital being \$10,000,000.

Commander TODD. You will note from that, sir, that there are 22,000 stockholders, of which 18,000 are in the United States. Four thousand are abroad. The reports that I referred to just now are two or three years old, but they indicate that one of those 4,000 stockholders is the British Marconi Co. With your permission I should like—

The CHAIRMAN. Proceed in your own way.

Commander TODD. Yes, sir. I wish the committee to know that this is not out of my own head; it is in print.

The Marconi Co. subsequently put up other stations. I have seen recently Mr. Bottomly's testimony—Mr. John Bottomly the vice president of the Marconi Co.—before the subcommittee of the Senate in 1912. He said they had 12 stations—the four that I have mentioned, probably one in New York, one in Boston, and three on the Pacific coast. I could not make out where the stations were at that time.

When the gentlemen of the Marconi Co. talked about their great system, which covers all the shores of the Atlantic, the Pacific, and Great Lakes, it left in the minds of the committee, I have no doubt, the idea that they had put up all those stations, equipped and manned them as part of their system; that this system as a financial success would suffer if the Navy went into competition with them; and that it would be a crime for the Government to buy them out. They did not state that when they owned these 12 stations, 4 or 5 of which were getting the cream of the wireless business of the country, that the United Wireless was a tottering structure with about 55 stations, covering the Atlantic and Pacific coasts and the Great Lakes. A number of big hotels down the coast, like the hotel at Wilmington, and the New Willard here—I know that at the time there were several of them—had radio stations on them, and the wharf in any port might have a United Wireless station on it. How much those stations were put up with the hope of getting a monopoly or getting business and how much they were put up for making a showing for selling stock was something that was debated very strongly in 1912.

The United Wireless Co. came along and opposed this bill, or, rather, the act now in force, mildly. They wanted some regulation. They believed in licensing. They suggested, as every single radio company, or manufacturer, or inventor does before this committee, certain provisions that in some way favored their inventions, or their apparatus, or their ambitions, or their patent rights. Toward the end of the hearing it was quite clear to the committee that they were for regulation. Shortly afterwards they went into the hands of a receiver and some of their head men went to jail, I believe, temporarily. The Marconi Co. bought them out, paying \$700,000 worth of Marconi stock for the system. There is the Marconi Co.'s extensive system that they have developed. I do not know what the terms were, but at any rate (that occurred about the time of the London convention) there was a stock flurry. The capitalization of the Marconi Co. was increased somewhere about that time and a great deal of stock was sold. There was some scandal in England about the American Marconi stock manipulations of certain men, including two Cabinet officers. There was a long investigation, suits for libel, etc. It was all in the newspapers and quite open to the public.

I give the above to emphasize the point that the Marconi Co. has always looked for a monopoly and is against any regulation. They say they are for the present law—because they have been made to work under it by the Department of Commerce and it is naturally not so pernicious from their point of view as this bill which contains the idea of Government ownership.

At the time the present act was being considered by this committee and the Subcommittee of the Commerce Committee of the Senate the

National Electric Signaling Co. had other views. They were claiming that Prof. Fessenden's invention quite overshadowed anything that Mr. Marconi had done, and by their legal department they were seeking to demonstrate that, and held that everybody must come to them for efficient apparatus, as they had the basic patents. In the hearing before the subcommittee of the Commerce Committee of the Senate, page 29, I testified in the presence of representatives of the National Electric Signaling Co., the Marconi Co., and the United Wireless Co.—Mr. Kintner, Mr. Bottomley, Mr. Marshall, and some others were present—and I could not be controverted at the time, that there were about seven or eight suits going on, as follows:

EXTRACTS FROM PRINTED HEARING BEFORE THE SUBCOMMITTEE OF THE COMMITTEE ON COMMERCE OF THE SENATE, DATED MARCH 1, 1912 (PP. 28-29).

Mr. TODD. Mr. Kintner speaks also from the point of view of the manufacturing company which owns no operating stations, and which has, until quite recently, been selling a large amount of apparatus to the Government. In fact, some of their sets are being delivered to the Government now, and they had considerable business with the Government until they started to raise their prices on account of certain patent suits that are pending. For the information of the committee I should like to mention the patent suits that are now pending in this country to show how extremely mixed up the matter is.

Mr. Kintner's company, the National Electric Signaling Co., is suing Mr. Marshall's company, the United Wireless Co., on a patent which we believe means a patent on radiotelegraphy.

Mr. HAYDEN. May I ask if that is the case recently decided by Judge Hale?

Mr. TODD. Yes, sir. It is still pending. The decision was appealed by the United Wireless Co. As Mr. Kintner says, they have gotten out an injunction against them.

They have a suit against another company, which is called the Wireless Specialty Apparatus Co., with which they were until recently very closely related.

Then they also have an action against the Government for infringement of patents on account of apparatus bought from Mr. Bottomley's company and from the Telefunken Co. And against that company is an action by their late Prof. Fessenden, who is stated to have been wronged to the extent of \$700,000.

Senator BURTON. Is that an injunction suit or a damage suit?

Mr. TODD. That is a damage suit. I understand it was a breach of contract.

Senator SMITH. All this indicates that these Pennsylvania people haven't any monopoly of confusion.

Mr. TODD. Mr. Bottomley's company has brought suit against Mr. Kintner's company and also against Mr. Marshall's company and the New England Navigation Co. Those suits, I understand, are pending.

The patent on which Mr. Bottomley's company, the Marconi Co., is suing is also basic. It is also a patent on wireless telegraphy. If either one of those win, the winner will probably clean up all the others.

Since then the National Electric Signaling Co. and the Marconi Co. have gotten tired of paying lawyers and trying to get a decision on certain basic patents, and have come together in a patent agreement, of which I have a copy here. This patent agreement is such that their opposition, under two heads, is practically the same opposition. I wish the committee to realize that they are standing on common ground. They are working together. There are other suits or suits against other people which are still going on, and these suits have been touched on slightly by Mr. Clark.

(Thereupon, at 10 o'clock p. m., the committee adjourned until tomorrow, Thursday, January 25, at 10 o'clock a. m.)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, January 25, 1917.

The committee met at 10 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

**SUPPLEMENTAL STATEMENT OF COMMANDER DAVID W. TODD—
Resumed.**

Commander TODD. I wish to speak on the subject of neutrality. The neutrality rules were prepared by the State and Navy Departments in conjunction at the beginning of the war. The international or domestic legal points involved I can not answer for. Questions of neutrality are entirely departmental matters. The President, having issued a neutrality proclamation with especial attention to the neutrality of radio stations of the United States, assigned to the Navy Department the duty of carrying out those neutrality regulations. We found that it was comparatively easy with our own stations, but with the commercial stations the problem was very difficult. The Navy Department having been assigned this duty had to take very strict measures to make it effective; and the neutrality regulations were framed so as to make the radio-operating companies, those which operate stations on shore, I mean, responsible for letting messages be transmitted broadcast which might be considered unneutral by a belligerent. The Marconi Co. has complained, as you have seen in correspondence, and with apparent reason; but putting aside the practicability of providing a qualified officer for every radio station in the United States and its dependencies, no officer would be able to assure himself of the neutrality of messages sent unless he himself were an operator. Were he an operator, he could not possibly listen throughout the 24 hours of the day. That would mean that we would have to appoint three officer operators; it would take at least three.

The same thing could be accomplished by having at least three qualified naval operators, one always on watch, and an officer, present or within easy communicating distance, who could decide whether or not any message which it was proposed to send were unneutral. The operators could listen to the operation of the station and assure themselves that censored messages and no others were sent. The point I want to bring out is, that if there happened to be any temptation to use a station for unneutral purposes, there would be no way of checking it up unless some one actually listened to the actual dots and dashes transmitted. An officer and three operators in a private station would mean practical Government operation.

Naval censors are on duty at important points to assist commercial companies in deciding whether or not such and such a message is unneutral. All doubtful messages are submitted to him. In case of doubt the officer telegraphs the message to Washington and asks for instructions. We get several of them every day from Sayville and Tuckerton and telegraphic orders are sent back as to whether or not to pass the messages, or to eliminate certain parts of the messages concerned. Stationing an officer and three operators in every commercial station, I submit, is impracticable—at this time it would mean putting

a number of ships out of commission, possibly, and I think you will agree that in these delicate times it is much more important to keep the ships in commission and the officers training at sea, than to assign them to duty at these stations ashore. It points out the impracticability of carrying out the neutrality regulations other than by actual Government operation. Neutrality must be effective, and without Government control and operation, the only way to do it is to hold the owners of the stations strictly responsible for everything that goes out; to make them watch the messages and submit any of them that they are the least bit doubtful about; and hold over their heads the threat of closing their stations—which is the only hold we have on them under the law. The President may, by the present law, close stations in time of public peril. He would have to say that it was a time of public peril to close the stations or to operate them to preserve our neutrality. Is this not a matter of grave concern?

Regarding the charge that naval stations also have sent out unneutral matter every single case of the kind has been carefully investigated. The charge that the Arlington station sent broadcast a message containing unneutral matter—press—was very easily investigated, because there always is an officer on watch in the Navy Department, night and day, and nothing ever goes out except with his initials on it. It happened that at the time at which this message was alleged to have been transmitted our records showed every word that was sent, and the official report of the officer on watch on that point is unquestionable. No more reliable person than that officer can be obtained.

The news that the *Balch* sent commercial messages to the Siasconsett station which mentioned the operations of a German submarine off Nantucket Shoals—that is news to us. We have an official report from the officer in command of all these destroyers that no messages containing references to this German submarine were sent except in code. I can not dispute the fact that the Marconi Co. has copies of the messages in question; but, as I say, it is news and a subject for investigation. I can not say that no naval station has at any time sent out matter that could be considered unneutral; but such cases have been very rare, prompt action has been taken, officers have been relieved of their duties with extreme promptness, and other disciplinary action taken. None of us are perfect. Every human activity is fallible and we can not absolutely insure neutrality even with the stations under the strictest discipline; but I submit that we have a much greater chance of getting what we want done in our own stations than we have of getting done what the President wants us to do in commercial stations.

The CHAIRMAN. Have you any evidence that these commercial stations have been sending any unneutral messages or have embarrassed the Government in the enforcement of the law and regulations?

Commander TODD. Yes, sir. There have been three noted cases which have been the subject of considerable correspondence. The first one resulted in the closing of the Siasconsett station for several months.

The CHAIRMAN. You mentioned that one, I believe?

Commander TODD. I believe not. That was about two years ago. Another unneutral message resulted in the correspondence with the

Marconi Co., which Mr. DeSousa read to the committee. Another case was "press," sent out by the New York Herald station, containing unneutral information, which was handled in the same manner.

The last two cases were the result of the sudden appearance of the German man-of-war submarine on our coast.

The question of neutrality is involved in other considerations which I hope to bring up later.

Let me speak now on the subject of the international conferences on radio telegraphy. The committee has heard statements which do not express the full situation to my mind. It happened that the second formal international conference was held in the same year in which this radio law was passed. It devolved upon me to work with Mr. Chamberlain and others in the interests of some sort of radio regulation, and in preparing to present proper arguments before the committees of Congress we had to study up very carefully the Berlin International Convention of 1906, which most nations had ratified except ourselves—all the arguments for and against ratification and, generally, the whole history of the matter. I was a delegate to the London conference, and for that reason had, especially, to look up the American viewpoint of the subject. From the testimony given by the commercial companies before the committees of Congress and from conversations with the individual representatives of those companies I found that the latest advance in the art pointed toward an increased range of wave lengths for ships, an increased use of the possibility of tuning and use of different wave lengths; and that we had then, as we have now, the American idea of speed, of covering great distances, and a much broader view than it appeared that the framers of the Berlin convention had held.

The theory of the provisions of the Berlin convention was, that since there was such a thing as interference, which there still is, the interference could be kept down if ships would not use high power so that their communications would not reach farther than they should, and the nations, in ratifying the Berlin convention, obligated themselves to provide a sufficient number of radio stations along their coasts so that any ship approaching their shores from any direction, or proceeding along them, would, when within 100 or 200 miles, have communication with some radio station. That became our obligation, and we have fulfilled it. The ship was required to send to the nearest shore station and to send only with sufficient power to reach that shore station. No provision was made by the Berlin convention for the use of the 1,800-meter wave length, but the question of using these higher wave lengths was left entirely free to every Government. For general public correspondence common to all nations, common to all coasts, all administrations, it was the theory that the ship had most use for communication when they were approaching port or leaving it, or proceeding along the coast, and that then it was always within reach of a station. Only sufficiently powerful stations were necessary to keep up communication over these moderate distances. That theory permitted the use of apparatus which did not require to have the wave length changed, except from 300 to 600 meters, or vice versa. They could set the apparatus so that it could handle either 300 meters or 600 meters, and if there happened to be two or more ships in a given area that had to communicate with different shore

stations or with one another, and might therefore interfere, one could use the 300 and the other or others could use the 600 meter wave length. Two ships could use the 300 or 600 meter wave length to communicate, while other ships, in turn, could communicate with the shore without being interfered with. That was in accordance with the development of the art in those days.

When I came to inquire among the commercial people concerning the question of using 300 and 600 meters for all this with no other change of wave lengths and no extension into the field reserved by all the Governments for governmental work—that is, above the 600-meter wave length, up to 1,600 meters—I found that the use of the 300 and 600 meter wave lengths suited Marconi apparatus and operators, suited the United Wireless apparatus and operators, and those two companies had apparatus on practically every ship of the merchant marine, owned either here or abroad, that visited our coasts or was engaged in the coastwise trade. Between them they had a practical monopoly. Those wave lengths were suitable to their operators in those days. The companies, which at that day represented the latest advance and whose apparatus was more suitable for using the higher wave lengths, naturally strongly urged that the range for ship-to-shore work be increased; that the reservation that all Governments have kept be broken; and that ship-to-shore communication be permitted on other wave lengths in that range which they call the “cream of the ship-wave lengths.”

We arrived at London with a big delegation and with proposals to increase the range of commercial wave lengths. We got no sympathy whatever. The delegates of European nations said: “We are working very successfully in handling all of our business with these 300 and 600 meter wave lengths. The coasts of Great Britain are visited by many more times the amount of shipping you ever see, and there is no question about it that every ship has all the communication she can possibly want, and there is no necessity for this change.” We were surprised to find that the Germans were for the same thing, and the Germans in that day had the most efficient apparatus of all, and possibly have yet. In the face of that, naturally, all the lesser nations followed along after France, England, Germany, Russia, and Italy, and were all for retaining the wave-length provisions of the Berlin convention; and our proposition did not amount to anything. We made no impression. They insisted that the business could be carried, and was being carried on, on those two wave lengths over there.

Mr. Terrell was also a delegate to the international conference, representing the Department of Commerce. He calls my attention to this additional proposal of the United States: “Any wave length which does not exceed 800 meters” (there is the exception which was mentioned by some of the commercial concerns the other day in the hearing) “or which is greater than 1,600 meters, shall be admitted for the service of general public correspondence.” The extension to 800 meters satisfied the advanced commercial companies at that time for the “cream of the ship-to-shore business,” as they called it. That is all on that subject.

The CHAIRMAN. That was the proposal of the American delegates? Commander TODD. Yes, sir. You see that we went over there with

the interests of the commercial people in our minds. We said: "The limitations of the governmental installations to this extent are not of importance, because if other nations give up part of this reserved range they" will be no better off than we shall be; if they can afford to, we can also work with this reduced range of wave lengths for men-of-war." The necessity for some long-distance transmission by ships was brought up, and the result was the ships were allowed to use 1,800 meters for general public business, provided they communicate with stations of their own country, and provided that that 1,800-meter communication did not interfere with any other radio communication.

In a minute I will speak of the next international conference, but I want to call the attention of the committee to the fact that the commercial companies have not made clear to you that they are free, expressly allowed under the present law, to use other wave lengths from 300, 600, and 1,800 meters. The only range they are prohibited from using is 600 to 1,600 meters. They are actually licensed for other wave lengths under 600 meters and do use them, and above 1,600 meters the field is entirely clear, except that if they handle general public correspondence—that is, messages of passengers on the ships to somebody on shore, or vice versa—that work shall be done on 1,800 meters. By the convention the Government could permit stations to handle certain limited business by other wave lengths.

The CHAIRMAN. Article 2 reads:

In addition, each Government may authorize in coastal stations the employment of other wave lengths designed to insure long-range service or any service other than for general public correspondence established in conformity with the provisions of the convention under the reservation that such wave lengths do not exceed 600 meters or that they do not exceed 1,600 meters.

Is that it?

Commander TODD. That is it.

The CHAIRMAN. That is article 2 of the regulations.

Commander TODD. In theory an extended range of wave lengths for commercial purposes would be used exactly as we use it for military purposes; that is, to be sure always to get the ship or station you wish, every ship and station must have some calling wave length on which the operator is listening, on which he is expecting to be called, not as some gentlemen have testified, either before this committee or some other, that an operator is always moving the knobs, etc., on his receiver to pick up anything over the whole range. Some of the best ones do that, of course—the very attentive ones; but the average man does not. He knows what communications he may expect to have at a given time and place, he knows what the regulations require him to use, and he ordinarily is prepared to listen on that wave length. There is one wave length for calling. When called you listen in and see what communication is going on in your neighborhood and note a pair of ships talking on 300; another ship talking on 400 or 450; so you decide to communicate on 550 or higher. You give a signal to the other station, and both shift transmitters to this new "tune," as we call it. That is the theory of it. How does it work out? The Navy discovered a good while ago and developed what we call the tune shifter, and we are prepared on every ship in the Navy for the apparatus to take up any one of a number of tunes, simply by turning a wheel, or a pointer to a mark, or by some similar arrangement. The

commercial companies have not done that except in very few instances. I won't say that they have not done it at all. In all of our naval shore stations we are prepared, as a rule, to change quickly from one wave length to another through an extensive range. Commercial stations have generally only two or three changes. They proposed to adopt the quick-change system four years ago. In the meantime we have developed it to a high degree, and it is so necessary to our organization that we would not know how to do without that system if we had to.

The United Fruit Co. in the Caribbean is in a peculiar position. It has these two shore stations and a lot of their work is between New Orleans and Swan Island, and with ships in between. Everything coming from the South, all communications between ships and shore stations on foreign soil in Central America and South America, and the work collected by these stations, passes through Swan Island and so to New Orleans. Mr. Davis did not make clear that the work between New Orleans and Swan Island could be carried on on any wave length above 1,600 meters, provided he could make suitable arrangements with the naval station and the Marconi station at New Orleans to keep clear of that wave length. He did not point out that the longer wave lengths are more suitable to this transmission than the 1,800 meter reserved for ship to shore communication, and, of course, the shorter lengths. That should be clear in the minds of the committee that he has an unlimited field over 1,600 meters to whatever the future may decide to be the limit, if there is any. We do not know of any yet. We are working toward higher wave lengths all the time. I would say the United Fruit Co. proposes to put in the finest apparatus obtainable in their stations. What apparatus? The apparatus the Navy has helped to develop by its encouragement and which the Navy has found, by exhaustive tests, to be the very best obtainable. They are a progressive, live company. They must have the best apparatus on account of the peculiar climatic conditions causing that interference, which Prof. Pupin calls "God-made interference," or something like that—the celestial interference. They must have the best apparatus there, and if Prof. Pupin or any other scientific man would invent a "static" interference preventer they would have to have it for their business, whereas now they have to substitute high power for an interference preventer. They are as strong after it as we are. When Prof. Pupin, some time ago, said he had an interference preventer (I mean celestial interference, what we call "static," "strays"), we invited him to come to our Arlington station and make his experiments. He came here and we told him that we experienced considerable trouble from static and would be very glad to assist him in every way by lending him that station, with its towers and high wires, to perfect his device. Prof. Pupin came to the station. It is a fact that stations which have a great spread of wire, and especially where the wires are high above the earth, pick up much more static than a station with a low antenna, or which receives on a single wire, close to the ground. The static comes in crashes, and in the bad season of the year, in the summer, the conditions are sometimes impossible; you can not do a thing. I am told that Prof. Pupin put the telephone receivers to his ears and

listened for a minute, laid the receivers down and said "I did not know what static was before," or words to that effect. He went away and we have not seen him since.

Mr. GREENE. How long ago is that?

Commander TODD. I do not know. Mr. Clark, when was Prof. Pupin at Arlington?

Mr. CLARK. It was about the time of the Vera Cruz incident.

Commander TODD. That was two years ago.

Mr. CLARK. Two years ago; yes.

Commander TODD. Prof. Pupin has said recently, within the last few days, that his interference preventer is coming along nicely and he expects to have it soon. He expects great things from it. All these radio scientists are optimistic by profession. The very word "radio" has an encouraging sound to it. They see vast possibilities; they are dreamers; claim that no one can dream the possibilities of this science, and they are quite right.

Mr. GREENE. Even though he did not come to your station, might he not have still been continuing his investigation?

Commander TODD. Oh, yes; he undoubtedly is—and there are dozens who are doing the same thing.

Mr. GREENE. And undoubtedly he has made some progress?

Commander TODD. Yes.

Mr. GREENE. But he says he has not developed it in full, and it is a long process to do it with any ordinary man, and he is an extraordinary man, and he says he is going to perfect it and he might perfect it without going to your station?

Commander TODD. Oh, yes; very easily. It is not necessary to have any high power station.

Mr. GREENE. And it is not any particular criticism of Prof. Pupin, it does not seem to me that he has not seen fit to go over to the Arlington Station and give up all the information he has so that the Navy Department may adopt his plan before he gets it into practice, or anything of that kind. It seems to me he is not to be criticized for not opening up all of his ideas to the Navy Department and letting them have them so that they can use them without any consideration at all. He might want to dispose of his ideas, if he has any, and naturally he would if he is in the business of trying to dispose of his ideas and he might not feel disposed to turn them over in advance to the Navy Department before he has had a chance to develop them.

Commander TODD. Probably not, sir. I can give you some ideas on that. The Western Electric Co. has developed this wireless telephone. We have permitted them to use the Arlington Station, with the results you have seen published in the papers.

Mr. GREENE. I have not seen them. I have a great deal to read and I can not read them. No, I have not seen them.

Commander TODD. The results were remarkable. That apparatus is over at the Arlington Station now and we do not know what it is except in a general way. The Western Electric Co. has not opened its heart to us. They say it is still in a state of development, and we ask no questions. The apparatus is locked up and we are waiting until they are ready and willing to show us the inside of the completed instrument. Prof. Pupin would have been treated with exceptional consideration, because a device to cut out interference from

celestial, "God-made," signals would be of vast importance to us, of much more importance than radiotelephony.

Mr. GREENE. He might find, possibly, that he could develop it better by himself than he could under your supervision. He might find that was better. I certainly would if I was going to develop anything; I would rather develop it somewhere by myself rather than go tie myself down with somebody who would grab what I had.

The CHAIRMAN. I think the gentleman has a misapprehension. You simply placed your station over there at their service?

Commander TODD. That is the idea.

The CHAIRMAN. You did not place any limitation on it?

Commander TODD. No, sir.

The CHAIRMAN. He did not have to sell anything to the Government that he might develop?

Commander TODD. He did not.

Mr. GREENE. Oh, no; but it is like a Government leak.

The CHAIRMAN. I am rather inclined to think that young Armstrong will develop his invention along that line before Prof. Pupin. We do not wish to get these highbrows' inventions and keep them from getting their just deserts.

Mr. GREENE. Do not worry; we will look after that.

The CHAIRMAN. We will look after that ourselves.

Commander TODD. Every highly scientific radio man in the world and many others are working on this problem of interference from strays or static. Undoubtedly progress is being made, but the extravagant claims that were made years ago are still unfulfilled and we are watching for it with great care because of the world-wide interest in it. There is nobody that does not want to know how to get rid of static. For military purposes it is of very great interest, and the commercial field would be widened by many thousands of miles if it could be done.

These commercial companies that complain of the limitations of wave lengths I don't say they are talking entirely from a theoretical point of view, but to some extent they are. The United Fruit Co. could use longer wave lengths in the Caribbean to advantage; they are progressing and they will eventually equip with arc apparatus, I am sure, all their ships. They recognize good apparatus and so they watch what the Navy is doing. They want good operators and they employ many ex-Navy men. I am informed that quite a number of their operators are men they have taken from the Navy and given higher pay.

There was some question of whether the Navy operators were paid sufficiently well in comparison with commercial operators or were forced by the terms of their enlistment to do important work for small pay. I might say that the green operator comes out of school and gets \$33 a month and all his food, lodging, and medical attendance. He is rated electrician, third class, radio.

The CHAIRMAN. Are they civilian employees or enlisted men?

Commander TODD. Enlisted men; in many cases they are boys.

The CHAIRMAN. Now, what do these operators get on the commercial ships as operators for the Marconi and other companies?

Commander TODD. I am not sure; I think that was testified to, sir. I was talking about the boy who has just come from the radio school.

The CHAIRMAN. None of them get very high pay, from all I have heard about it.

Commander TODD. Our men, inside of four years if they are good, go right up to \$66 a month. With their reenlistment comes additional bonuses, bringing their pay up to \$84 per month, and it is quite possible for them to go up to \$90 and, in some cases, after considerable service, to \$100 a month, with their food, lodging, and medical attendance, and freedom of mind for the future, because, if they serve a certain number of years, they may retire on pay. They are really very well looked out for and are happy. Fortunately, it is the good men who stay with us and the mediocre ones, the restless ones, the trifling ones, are the ones who go into other activities. Of course, on account of promises of higher pay some leave the Navy at the end of an enlistment.

The CHAIRMAN. Do you know of any that go from the Navy; that is, from the ship stations to the merchant ships?

Commander TODD. I do not. I do not think—

The CHAIRMAN. How do they shift—from the merchant ships to the Navy or from the Navy to the merchant ships?

Commander TODD. Neither, to any extent. We get most of our operators from the bottom, sir; they are ex-amateurs or bright boys who are first tried out with signals. If they are amateurs and show that they can send and receive a certain number of words, they are chosen right away for that reason. Ordinarily, we take the bright operators, start them off aboard a ship, and then we send them to the radio school in the navy yard, New York or San Francisco, where they are given instruction in radio telegraphy and the construction of apparatus and the use of it. Then they are given a finishing cruise on a battleship, on a destroyer, or collier, or some of the other ships. On reenlistment for a second cruise, or towards the end of the first cruise, depending on the pressure from shore, they are sent to the shore stations, where they get training at that end, and after two years at the shore stations back to sea again. In that way we create an intimate knowledge between shore-to-ship operation. The two must cooperate exactly, because it is recognized by the students of naval warfare that communications have a most remarkable bearing on the outcome of a campaign—they are all in all up to the moment of battle.

I will now speak of the next conference. We found that the nations over there had made up their minds that for the next conference they would like to meet in Washington. That took us by surprise. We immediately cabled home, and the State Department said that we might extend the invitation, subject to the approval by Congress, who would have to be asked to furnish the money for the expenses of the conference and for the entertainment of the foreign delegates. These conferences are very formal and important affairs. Each country sends quite a number of delegates, and both in Berlin and London they have been given exceptional opportunities to see all the radio and electrical manufacturing plants and stations within reach of the capitals and have been entertained. So in those words they were invited by the American delegation to hold the next conference in Washington. The date was set for this year—1917—but that conference can not be held until commerce has had a chance to readjust itself after the conclusion of peace, ending this terrific

war. The conferences deal with commercial workings, not with any military or political affairs, so commerce must be in working order before they will know what they want in this matter.

When that conference does take place the American delegation will be in a very favorable position for advancing the interests of American commerce or American radio concerns. Concerning Prof. Pupin's suggestion that there should be no Government ownership, but that an advisory board of scientific men be substituted, would be one well worth considering, as far as the advisory board is concerned, when this next conference is imminent. Those scientific men might get together and decide what changes in the present convention will be necessary and be prepared to argue them before the conference—in other words, to show this conference of many nationalities, as it may turn out to be, to show them how far behind the times they are.

The question of regulating international communication through high-power stations, communication between stations on land, came up at the last conference. It was passed over for the reason that there were not then a sufficient number of high-power stations actually working, although many were proposed, and the different nations had not experience enough to make any assignment of wave lengths or other arrangements to keep those stations apart.

The next conference will have to take up that question with great seriousness. It has been pointed out that the development has been along the lines of high-power stations, and a number have been erected for military and commercial purposes in various parts of the world. We have eight of the latter, as I said, in our own country. That matter must be gone into very thoroughly at the next conference. It will take considerable study to know what can be done, and I personally very earnestly hope that by that time we will be in a position to say just what we can do with the high-power stations in the United States, because we have operated them and know their requirements, know how hard it is to keep from treading on one another's toes, and how much harder it is to keep their communications from disturbing their neighbors on the other side of the water.

I ask the committee to consider the backing for the principle of Government monopoly that we have at this time. It has devolved upon me to present the principal arguments in favor of this bill. That comes to me from the committee which prepared the bill. The committee worked an entire year on this. The military and non-military departments had to get together on something. Here is the bill that represents their efforts. The bill has the approval of every executive department of the Government; the entire executive is behind it, except the President himself. He has so many big subjects on his mind that what to us appears a big subject can not easily be brought to his attention. Six or seven of the executive departments—I have not seen them all yet—are recommending this bill in the very strongest terms, recommending that Congress at this time take up the subject of complete Government ownership of radio stations on land for very many strong reasons that have been brought out before the committee. There is the Government side of it. We have the strongest backing from the executive branch of the Government.

You will notice that quite a number of the steamship lines have written letters or telegraphed to the committee urging that the

Government be allowed to handle the shore stations, as it would further their interests. Naturally, a number of independent manufacturers have urged its passage, as it would further their interests. The owners of the Sayville station see the handwriting on the wall and have written to the committee urging that the Government acquire a complete monopoly of the shore radio stations, which includes their own.

The London convention was proclaimed by the President with these words, "To the end that every article and clause thereof may be observed and fulfilled by the United States and the citizens thereof." I want the committee to believe that the Navy Department has in good faith tried to carry out the provisions of this conference and to work in close cooperation with the commercial companies. We have not cut under them in rates. We have not requested a division of time at any place as allowed by law. We have not broadened our use of the wave lengths so as to interfere with them; we have kept clear of them in every way possible, especially by keeping to the higher wave lengths and installing first, "quenched-gap," then arc transmitters. That is attested in these hundreds of papers concerning interference. The question of malicious interference does not come in. Both sides, both the commercial and Government stations, are trying to work along harmoniously. I do not want the committee to feel that should the Navy get complete control of the coastal and commercial stations the commerce of the United States is to suffer; but on the contrary it will be assisted in every possible way.

You will notice that the range of wave lengths from 600 to 1,600 meters is reserved for governmental purposes. Should the Government own all the shore stations, it seems to me that there are many ways in which the business of the Government, as far as the use of the Government wave lengths is concerned, could be extended to include services to commerce in addition to the service to commerce that we are already carrying on, in the shape of sending them weather reports and storm warnings and information concerning dangers at sea—derelicts, buoys, and lightships adrift, lights out—and the time service by which the navigators can check up their chronometers.

We hope we have made it clear that we are far more anxious to develop the latest devices and get them into use, and get them fairly, than the commercial companies can be. If they were as anxious, in a broad sense, they would be quickly narrowed down by the question of expense.

Now, Congress has shown great confidence in the Navy and in the naval radio service. You have furnished the money for these stations. We have had them for years, and we have carried on the work as best we could with commercial stations for neighbors. You have furnished the money for buying the latest apparatus; you have allowed us to equip our ships so that we believe that we are ahead of foreign nations. I might say right here that the capital ships which have cost so much money, have a very elaborate radio equipment, with all the possibilities of battle provided for as far as our information from abroad and our own experiences enable us to foresee them. Congress is showing its confidence in the Navy in general by furnishing naval officers with these enormous ships of unheard-of

power for them to command, and to get the best out of them for the service of the country. You may depend upon it that their radio equipment will be up to the highest standard of equipment of guns, torpedoes, armor, and, of those that carry aeroplanes, of flying equipment, and we hope that Congress will take the view that the Navy can be trusted to look out for the best interests of the Nation as far as the question of radio communication with commercial ships is concerned; and eventually in the operation of high-power stations, whose activities spread so far beyond our boundaries and bring us into closer relations with foreign countries.

Mr. GREENE. That seems to be all right so far as you state in regard to the Navy. Of course, you are a naval man; but in stating what radio is doing for the Navy and so on, where do the commercial interests come in—with what leaks over after the Navy get all they want? Or if a merchant or any commercial organization wanted to get some information and they should call for it, are they to have it; or is that to be put aside until after the Navy take what they want, and then they take what the Navy leaves?

Commander TODD. That is easily answered, sir.

Mr. GREENE. I would like to have your answer.

Commander TODD. The Navy is far ahead of the commercial shore stations and ships, especially the ships. The ships lag behind. Their equipment is very slowly changing to more modern apparatus.

Mr. GREENE. I am not asking in regard to apparatus; I am asking you a—you were talking about what Congress has done for the Navy and what they are willing to do for the Navy and the number of vessels they are willing to provide although they can not yet provide the men to go aboard them and they have to transfer from one vessel to another, as I understand it, in order to get enough to equip the vessels they have. My question is, you were talking about you were doing so much here, and we understand that, but in your assumption of taking over the commercial interests besides, where will these commercial interests come in?

The CHAIRMAN. In other words, if you eliminate the Marconi Co., how are the commercial interests of the country going to be served?

Commander TODD. It am not sure whether you refer—

The CHAIRMAN. AS I understand, your suggestion is if the Government takes over all the stations, it would render not only the service of the Navy but for the commercial interests of the country as well. Is that your idea?

Commander TODD. That is the idea. We propose to handle the commercial work of the country better than the commercial people are doing it at the present time, in that we will be able to work in their communications with our own, and there will be none of this correspondence about interference, and disputes between operators and stations, and questions of where stations shall be located, and how they shall be operated. The commercial companies will be encouraged to develop apparatus to go on board ships, so as to increase their possibilities; to develop apparatus for the Navy which the Navy must buy; and to sell to foreign Governments.

Mr. EDMONDS. What do you do now with the commercial work; take care of it after all the Navy work is finished or take care of it along with the Navy work?

Commander TODD. That has been covered in the testimony, sir. We handle the military work in what are called the medium power stations with what is called arc apparatus—the ship to shore work is ordinarily with what is called spark apparatus—but the stations that have the arc apparatus have been or are being fitted with the distant control arrangement which allows them to work with ships and with distance stations at the same time. That is, the military work and the commercial work go on side by side.

Mr. GREENE. I fail to understand now. I do not get what I want to get, if I can. Wherein does the commercial work—where will that be provided for if you take up this proposition of assuming that the Government is to control everything relating to wireless and then is to put it under the Navy Department, where do the commercial interests come in? The Navy Department might conclude, in time of peace, that they wanted to use all their time; that they would have to have more men on board their vessels, they would have to have more operators, they would have to go to a great deal more additional expense. Where do they get their compensation for it—in taking care of the commercial business, or do they intend to turn it over to the stations that are left, that they do not happen to take away? They propose to take away, as I understand it, under this bill—what you want to do is to take all those commercial stations, to scrap those you do not want and to keep those you do want, and then where do the commercial interests come in. That is what I want to know, under your plan. You have not answered that to my satisfaction yet.

Commander TODD. The commercial interests are limited to the operation of apparatus on merchant ships.

Mr. GREENE. Don't they have any business on shore?

Commander TODD. None at all, sir; absolutely none.

Mr. GREENE. The commercial interests do not now?

Commander TODD. Now, they have; yes, sir. But this bill proposes—

Mr. GREENE. To take it away from them?

Commander TODD. To take it away from them; yes, sir. The bill itself does not, but the ultimate result of that bill will be complete Government ownership, in my opinion, within five years.

Mr. GREENE. Then we have not begun to see what is to come out of it. If the bill is not complete, let us make it complete. If there is some scheme behind it, if after you get a part hold, then you propose to grab the rest of it, let us have all of it in the bill, let us have all of it come out in the testimony; do not hold anything back; let us have the whole situation.

Mr. EDMONDS. I think that has been developed in the hearing, already.

The CHAIRMAN. I think it has been reiterated over and over again, and developed in the hearing.

SUPPLEMENTAL STATEMENT OF MR. DAVID SARNOFF, COMMERCIAL MANAGER OF THE MARCONI WIRELESS TELEGRAPH CO. OF AMERICA.

Mr. SARNOFF. Mr. Chairman, I would like to say a few words in regard to the rebuttal testimony which has been given by Commander Todd and Mr. Clark. In the first place, it seems to me that you cer-

tainly must have been impressed with the earnestness that has been exhibited by both parties to this controversy. I think that we have endeavored to throw the whole light on the subject. For this reason it seems to me a matter for regret that the Navy, in its rebuttal, should try to impute motives to the commercial companies which are not borne out by the facts, and I will state specifically to what I refer.

In the first place, Commander Todd inferred yesterday, in fact has stated, that the commercial companies have come here to dicker as to the price which they would wish to receive from the Government for the commercial stations. Perhaps he did not use exactly those words, but he did say that you can not expect the commercial people to come here and say to you that they want to sell their stations even should they want to do so, because that would affect the price they might eventually receive. Now, so far as the Marconi Co. is concerned (and I am here representing the Marconi Co.) I want to say as definitely as possible that the Marconi Co. does not want to sell any of its coastal or high-power stations. The commander's assumption is perfectly ridiculous. The Marconi Co. has spent millions of dollars in its high-power stations, and only during the last year we have spent a great deal of money in improving our coastal stations. I have personally been in charge of that work and know that large amounts of money have been spent in this direction. Had we any idea that the Government would take away our stations, do you suppose we would be spending our money at this time in improving them? Therefore, I do not think that Commander Todd is justified in making his assumption. And I want to repeat again that the only time the Marconi Co. will give up its coastal or high-power stations is when the Government, through the proposed legislation, forces the Marconi Co. to do so. Of course, it is understood that the Marconi Co. would be very glad to cooperate with the Government and turn over its stations to the Government in time of war or national peril.

Commander Todd also said yesterday that one of the reasons why the Marconi Co. is contesting this bill so vigorously is, that the Marconi Co., by maintaining its coastal stations, can say to the shipowner, "Well, now, you must have Marconi apparatus on your ships or else we will not give you the service through our coastal stations." This, too, is not correct, for the facts are, that there are at present about 60 or 70 vessels of the American merchant marine equipped with Kilbourne & Clark apparatus, a competing company of manufacturers; there are 15 or 20 vessels equipped with Poulsen apparatus; there are about 25 vessels equipped with Haller-Cunningham apparatus; the United Fruit Co. on its vessels does not carry Marconi apparatus—and all of these vessels communicate with the Marconi Co. coastal stations. Moreover, the present law enforces any company owning coastal stations to communicate with any other stations regardless of the system employed. This is not only the American law, but it is the law of the London convention to which your attention has been directed. Therefore you will see that the Marconi Co. can not control the apparatus used on shipboard by maintaining coastal stations. And so the reason advanced by Commander Todd seems to me to fall flat.

Commander Todd has also referred to the neutrality proposition this morning, and were it not, gentlemen, for the seriousness of this neutrality proposition, I should indeed take some amusement out of what Commander Todd has had to say. He has said that the Government did not find the same trouble with the Government stations as it did with the commercial stations. Why not? Because the Government stations have violated the very rules which the Navy Department has formulated for observation by the commercial stations without being troubled by anyone, for they are apparently a law unto themselves. And what has Commander Todd said in regard to the evidence produced by the Marconi Co.? He said that he does not know; that it is a subject for investigation. He does not know, but he does not dispute the fact that we have produced evidence showing that the Navy has violated the censorship regulations.

Now, suppose the Marconi Co. had done exactly the same thing that the Government has done; what would have happened? You have heard, gentlemen, the letter read from the Navy Department, signed by the honorable Secretary of the Navy, but written, I believe, by Commander Todd himself, where he threatened to close the stations of the Marconi Co. if it repeated the transmission of any message the unneutrality of which is certainly not clear to anyone. And I would challenge anyone here or anywhere else to show that the message in question, which Commander Todd has considered unneutral, appears by its text as unneutral. Yet he says there is no trouble with the Government stations, and there is trouble with the commercial stations.

The commander has also said that the Marconi Co.—and it seems to me the Marconi Co. has been picked out as a particular target—has been satisfied with the 300-meter wave length and the 600-meter wave length. Of course we did the best we knew how when the regulations required the use of such wave lengths, but we have shown the limitation placed upon the commercial companies by these wave-length restrictions is a fact. I read a paper before the Institute of Radio Engineers, three years ago, outlining fully this subject of wave lengths and showing the commercial limitations. We are not blaming the law for that condition. It exists by reason of the London convention. But it has been outlined by others that the art has progressed since the ratification of the London convention.

The Chairman. There does not seem to be any disagreement among you about that.

Mr. SARNOFF. There is no disagreement about that, and it is the chief matter we have to find fault with in the present law. And, as I say, it is not the fault of the present law; it is the fault of the London convention. But I do not want the inference to be drawn that the commercial companies were quite satisfied with this wave-length proposition. Then, as now, they contended that it is not sufficient for the commercial ship and shore stations.

The CHAIRMAN. It seems our representatives in that international conference presented the viewpoint of the commercial companies in this country, but were overwhelmed by the foreign sentiment.

Mr. SARNOFF. Exactly so. That is precisely the reason also why that reservation has been made for the Governments; that is, the reservation from 600 to 1,600 meters. There was a preponderance

of naval and military representatives, and they chose for themselves the cream in entire ignorance, or, rather to the exclusion of the commercial interests.

Commander Todd and others who have testified for the Government have also indicated that the Navy's attitude toward the commercial coast stations and the commercial companies operating those stations has been one of benevolence. I want to refute that, gentlemen. It has been anything but benevolence, and I will tell you of a case which proves my contention. The Marconi Co. built a station several years ago at Miami, Fla., and expended a good deal of money on that plant. The station was built primarily for communication with Nassau in the Bahamas where the cable connecting Nassau with Florida had always been unsatisfactory. The Miami station also communicates with ships at sea. The Marconi Co. established a rate not higher than that authorized by the London convention and carried on that communication for a considerable period of time, when the naval Jupiter station in Florida became jealous—and I use that term advisedly—of the business conducted between the Marconi Co. and the Nassau Government and started competition. It went after the Nassau people and continually coaxed them to give Jupiter the business. The result was that the Jupiter station handled all the business with the Nassau Government instead of the Marconi Co. We protested against it and protested vigorously and brought the matter to the attention of the Attorney General of the United States, and after he investigated the case he ruled that the Navy had no business to handle that traffic.

Despite this, the Navy Department continued to handle the business 10 days after the opinion of the Attorney General was filed. What did the Navy do next? They had already established working relation with the Nassau government and they took advantage of that clause in the present act which specifically mentions the Key West Naval Station as one of the stations which may handle commercial business, and although Key West is farther away from Nassau than our Miami station, nevertheless Key West is now handling the business with Nassau instead of the Marconi Co. And unfortunately the law ties our hands. Now the purpose of the law, gentlemen, in regard to the naval stations handling commercial traffic is that the commercial companies should get the benefit of the commercial business, but that where no commercial company maintains a station for communication with merchant ships and other commercial stations, then and in that event only the Navy Department may erect or direct its station to handle the business. But here is a case where the Navy took advantage of the letter of the law, entirely ignoring the spirit of the law.

And yet there has been a question in the minds of some as to what the Navy would do if this bill, even without the Government ownership amendment, becomes a law; that is, if the Navy is permitted to compete with commercial companies. My illustration should convince you of the impossibility of continuing commercial stations if the Navy is given any further opportunities to compete than it already has.

Mr. Clark, of the Navy, testified yesterday. There are just a few points raised by him that I wish to answer. A good deal has

been said about the Institute of Radio Engineers. I have been secretary of the Institute of Radio Engineers for two years and am now secretary for the third year. I am also a director of the institute. This society of engineers is certainly doing great good to the country and to the radio profession in general, and I want to say right here that the members of the Government departments who are affiliated with the Institute of Radio Engineers are doing as much good as anybody else. We have the highest respect for them. They have contributed both by papers and by effort and we have no criticism at all to make. But I do take complete exception to the inference drawn by Mr. Clark yesterday as regards the resolutions which have been passed by the board of directors objecting to this legislation. As a director, I was present at the meeting and here are the facts. At that meeting we had a quorum of five directors, the five being Prof. Kennelly, who has testified before you; Prof. Goldsmith, who has written protesting against this bill; Prof. Stone; Mr. Weagant, chief engineer of the Marconi Co.; and myself. Thus there were two Marconi men and three independent scientists—Prof. Goldsmith and Prof. Kennelly have testified before you that they have no connection with any commercial radio interests. The affection that Mr. Stone bears toward the Marconi Co. can best be illustrated by the fact that in all patent litigation Mr. Stone has been on the opposite side to the Marconi Co. In fact, in the early days Mr. Stone had a system of his own in direct competition and has since contested the Marconi patents. Therefore, you will see that there was no Marconi coercion and that the reason for this protest by the institute is due solely to the foresight on the part of these directors that this bill, if enacted into law, would stifle the development of the radio art.

Moreover, those resolutions were read previously and presented to Commander Todd when the interdepartmental committee held its hearings some months ago. The resolutions were also incorporated in the minutes of the institute meeting and I sent them to all the directors of the institute. The resolutions were also read in open meeting before the membership. And not a single written protest has been received from any director or member of the institute. Yet, some gentlemen would have you believe that it was a matter of politics on the part of the Marconi Co.

I went to considerable trouble in preparing data regarding the messages handled in New York Harbor, and particularly from the Wanamaker Station, because that matter was one of dispute and it was raised originally by the Navy Department. But, after hearing Mr. Clark's testimony, I do not think I need take up your time, because he has already admitted to you, yesterday, that the Navy has succeeded in solving the interference problem in New York and can read Arlington at the Brooklyn Navy Yard when the other stations are working. That is precisely what we contended, but it took a long time to establish the facts.

Mr. ROWE. I think we would like to have the fact as to the number of messages handled by each company in the harbor of New York. Have you the facts?

Mr. SARNOFF. I have the facts, sir. I have gone over the records of the traffic handled by the Marconi stations, at Sea Gate, and the

Wanamaker Station in New York, and the Bush Terminal Station, for a period of 10 consecutive days. Of course I have no knowledge of the traffic handled by the Navy itself. But summarizing all the figures there is an average of 150 messages per day handled by these stations, and approximately 3,100 words. That is, these 150 messages have approximately 3,100 words, and these are handled during the period of 24 hours.

Mr. ROWE. Can you not give them by the stations?

Mr. SARNOFF. I can.

The CHAIRMAN. Give them for all the stations.

Mr. SARNOFF. For these three stations—

The CHAIRMAN. How many messages did you say?

Mr. SARNOFF. About 150.

The CHAIRMAN. One hundred and fifty messages by the three stations. That would be an advantage of 50 each day?

Mr. SARNOFF. Of course, Mr. Chairman, the Wanamaker Station and Sea Gate handle more traffic than the other station, but unless you want them distributed individually it would be that average. I can give these figures to the stenographer.

Mr. ROWE. I wish you would.

Mr. SARNOFF. The Sea Gate Station, for 10 days, handled 503 messages of 7,831 words. The Wanamaker Station for the same period of time, handled 766 messages of 20,818 words. The Bush Terminal Station for the same period, handled 259 messages of 2,916 words. And those equal the totals which I have given approximately before.

Mr. ROWE. Do they have any great amount of trouble in handling these messages?

Mr. SARNOFF. There is no trouble, sir, on the part of Sea Gate, nor on the part of the Wanamaker Station, and the representative of the National Electric Signaling Co. has testified that there is no trouble on the part of their stations as to the handling of this business. We do it every day in the year. The Sea Gate Station, as I testified, is probably the busiest marine radiostation in the world. It handles trans-Atlantic, as well as coastwise merchant ship traffic.

I have been manager of the Sea Gate Station and also an operator at the Wanamaker Station and handled the traffic myself. As I said before, I never heard the naval station in Brooklyn unless I tuned to the Brooklyn station. It was stated yesterday, and the naval officers now admit, that they have no difficulty in communicating when different wave lengths are employed; and no one here has contended that communication can be conducted with the same power and the same wave length. It would be just as impossible as if two men talked using the same pitch of voice and giving the same force to their speech.

But what has happened when using different wave lengths? Commander Todd himself testified this morning as to the wave shifters and the practicability of one station using one wave length and another station a different wave.

The CHAIRMAN. What is the wave length used by the Sea Gate station, the Wanamaker station, and the Bush Terminal station?

Mr. SARNOFF. The Sea Gate uses 300 meters and 600 meters for communication with ship stations. The Wanamaker station uses about 1,750 meters for communication with Philadelphia. The Bush

Terminal station uses 600 and 300 meters for ship service and perhaps other wave lengths for other services.

You have heard, Mr. Chairman, the National Electric Signaling Co. say that they proposed to open communication between New York and Boston. In this case they would use a special wave length. But it proves that if they were unable to carry on communication at present they would certainly not open up a new service right in the heart of New York Harbor. They propose to establish the new service along with the other work.

Mr. Edmonds asked Mr. Clark, in the course of his testimony yesterday, why it would not be possible to have one station use, say, 600 meters, another coastal station use 700 meters, and so on. Now, that is the obvious answer; there is no question about it. Mr. Clark said he imagines this could be done. I say as a practical wireless man—and I do not mean to say Mr. Clark is not a practical man, because he is one of the best radio engineers in this country—that it can be done. There is no trouble about it excepting the present restrictions of the law. Commander Todd himself has testified as to the wisdom of modifying this law at the proper time; but until it is modified let us not have any other law to place further restrictions on us and put commercial stations entirely out of business. The fact that these wave lengths suggested by Mr. Edmonds are not employed at commercial stations is not due to any lack of foresight on the part of the commercial companies. It is due entirely to the restrictions placed upon them. Mr. Clark has also testified that the art would not be stifled, because the Navy is a large purchaser of radio apparatus, and that particular point has been emphasized by so many that have testified in favor of the bill that it seems to me an answer is necessary. If the commercial companies are confined to selling apparatus to the Navy it would practically mean the commercial companies would be confined to selling apparatus to a single customer—excepting, of course, the ship stations which they had before. And if they are confined to selling their apparatus to a single customer it means they must take the prices and terms of that single customer. And yesterday you heard the difficulties of getting a reasonable price for apparatus sold to the Government and the difficulties of recovering the just dues that the patentee is entitled to. I do not think I need touch any further on that.

Mr. Clark has also mentioned several times the tests the Government has conducted on the U. S. S. *Salem*. The Navy gentlemen have shown you, or tried to show you, that the Navy is so far in advance of commercial companies in their research work that they actually sent a battleship to Europe so they could conduct tests. Now, of course, a commercial company would not spend the money for sending a ship to Europe to conduct such a test. And why should it, when it already has the commercial ships equipped with its radio apparatus? The commercial companies would not have to spend a nickel to make such a test. All they would have to do would be to put one of their experts on one of those ships going to Europe and equipped with its apparatus and to put on whatever special apparatus was necessary to make the test and then they could make not only one trip, but hundreds of trips, if they wanted to.

Further, the limitation of the art is evident from the bill itself. If the bill becomes a law, it would prevent such stations as the

Wanamaker station, for example, from continuing. And it would prevent railroad companies, who are now seriously considering taking up wireless as an adjunct and auxiliary to their communications in time of storms; it would prevent point-to-point communication in general and therefore would limit the art at once and would confine the operating companies to selling less apparatus than they can sell at the present time.

There is already sufficient legislation on the statute books, as has already been testified, and the present law does not stifle the art. It affords an opportunity for development and expansion not only in the wireless-telegraph field, but also in the wireless-telephone field. The present law permits the use of wave lengths above 1,600 meters for point-to-point communication, and when continuous waves are generally employed the wave lengths employed will be, in the majority of cases, above 1,600. Under the present law we can go ahead and develop the art with continuous waves, but under the proposed law we are limited. And here is the evidence of stifling the continuous-wave art and also stifling the wireless-telephone art.

In conclusion, gentlemen, I wish to make this suggestion: Both sides have spent so much time on this proposition and the committee has spent so much time, and so earnestly, in considering this bill that we ought to get some good out of this. Let us do so. We do not say conditions at present are perfect, and the Navy Department agrees as to that. It seems to me if we accept the three suggestions made by others that we will get good out of the whole proposition. Prof. Pupin's suggestion for a national radio advisory board similar to the aeronautic board is excellent. That can not be disputed. Then, there is the suggestion made by Gov. Griggs in regard to the enlistment of the wireless-telegraph operators and others employed by the commercial companies, so that they will be available for Government service in times of need. And, thirdly, the advisability of modifying the present 600-meter restriction at the proper time so that the commercial companies may enjoy the same advantages as the Navy and continue to develop the art as they have done in the past.

I thank you.

Mr. EDMONDS. It was stated here yesterday that you operate under a license from the parent company in England.

Mr. SARNOFF. We have an arrangement with the Marconi Co. in England which permits the American Marconi Co. the use of all the inventions of Mr. Marconi and his engineers abroad, and we take advantage of that arrangement so that this country, under the present conditions, benefits from all the inventions made by Mr. Marconi and his engineers.

Mr. EDMONDS. Is there any objection to putting that arrangement in the record?

Mr. SARNOFF. There is no objection. I am glad to have everything I say in the record.

Mr. EDMONDS. I mean the contract.

Mr. FORD. The assignment from the English company to the American company is of record in the Patent Office.

Mr. EDMONDS. It is in the Patent Office?

Mr. FORD. In the Patent Office, I think.

Mr. EDMONDS. Could we have the agreement between you and the parent company placed in the record?

Mr. SARNOFF. I know of no reason why you can not.

Mr. EDMONDS. Will you put that in the record?

Mr. SARNOFF. I will ask the general manager of the Marconi Co. regarding this agreement.

Mr. EDMONDS. Is there any other company operating under a license from a parent company located out of this country?

Mr. SARNOFF. The Marconi Co. has associated companies and affiliated companies in the principal countries of the world.

Mr. EDMONDS. I mean any other companies. The Federal, the National Electric Signaling, or the De Forest: have they parent companies outside of this country, too?

Mr. SARNOFF. I do not know as to the Federal Co., but the other companies mentioned have not.

Mr. EDMONDS. They are purely local, then?

Mr. SARNOFF. Purely local concerns. I want also, if I may, to draw the distinction between what Commander Todd characterized as a subsidiary company and the fact; which is that the American Marconi Co. is an affiliated company. We are not a subsidiary of any company. The American company is controlled by an American management. Its policies are formulated and executed here. The apparatus used on ship and shore is manufactured in this country and designed by American engineers, and we are in nowise subsidiary to the British Marconi Co. The affiliation is essential because of the international communication which is proposed by the Marconi Co. We must have an agreement with people abroad, just the same as the United States Government would have to have an agreement abroad if it communicated internationally.

Mr. ROWE. Do they have a controlling interest in your stock?

Mr. SARNOFF. No, sir; they do not.

Mr. ROWE. The Marconi Co., of England?

Mr. SARNOFF. No, sir; they do not.

The CHAIRMAN. They own stock, do they not, in your company?

Mr. SARNOFF. Yes, sir; they do.

Mr. ROWE. And maybe you own some in theirs, do you—that is, your company?

Mr. SARNOFF. I would not be sure as to that answer; I do not know. Possibly we do, but I do not know.

Mr. EDMONDS. I do not mean your operating agreement; I mean the general agreement between you and the parent company, as to how far you can go and what you might do.

Mr. SARNOFF. Yes, sir.

Mr. EDMONDS. And what your arrangements are with the other affiliated Marconi companies throughout the world.

Mr. SARNOFF. I will ask the general manager for a statement.

The CHAIRMAN. Give us the conditions on which you may use the Marconi inventions.

Mr. EDMONDS. And also what provisions you have with the other affiliated companies and the parent company.

Mr. SARNOFF. I will endeavor to obtain this for you, sir.

Mr. GREENE. Is there any other data that you want to put in that would be of use to the committee?

Mr. SARNOFF. There is just one technical feature I would like to touch on. So much has been said of neutrality and the possibility of controlling these so-called unneutral messages if the Government

handled it. The development of the art is tending toward the reception of wireless messages without antennæ. It is not practicable at the present time over any great distance, but the Government itself has a good deal of information on this point. And it is not going to be very long before we can and will be able to receive a wireless message without an antenna, so that the Government will not even know who has a wireless instrument in his house. Now, how is Government ownership going to solve the problem if there is a belligerent ship outside of the 3-mile limit that sends an unneutral message to a person with whom it has made a previous arrangement, and then this person assists a belligerent ship from a neutral base? Gentlemen, if the Navy has failed in anything by its testimony it has certainly failed to show how the Government can do anything under Government ownership that it can not do by intelligent regulation of the commercial companies and commercial stations. And in addition, at the present time whatever difficulties to our neutrality do exist are rather difficulties to the wireless commercial interests and to the Government of the United States, which under the proposed bill would assume all responsibilities which it need not assume.

Also, with regard to the wireless telephone, the question was very properly asked—and, I believe, by Mr. Rowe, when Dr. De Forest was testifying—how censorship regulations could be made to apply to the wireless telephone? That they could not be made to apply is obvious, because you can not censor speech until it is spoken, and after it is spoken, of course, it is too late. You can not very well censor speech. And, moreover, if the wireless telephone becomes a reality—and I share the view of Dr. De Forest as to the future possibilities of the wireless telephone, for it is coming, and coming quickly—then the method of communication will probably be this: Radiotelephone stations will be connected to an ordinary land wire telephone, and any person at home or at their office will pick up their telephone, ask for a connection with the radiotelephone station, and then the energy will be transferred to the wireless transmitter and radiated from the antennæ and received by the receiving party on board the ship, and vice versa. How could you censor that? You would have to put a censor in every house where there was a wire telephone, unless you took the radio station over itself, and of course the Government can do that in times of war under the present law.

Mr. ROWE. You transfer messages now, do you not? That is, you can take a telephone in New York and use the telephone from Brooklyn over to New York and the wireless to Arlington?

Mr. SARNOFF. You can if you have sufficient power at the transmitting end.

The CHAIRMAN. The only possible way in that event would simply be a prohibition against sending a message or communication without first submitting the message of conversation to a censor.

Mr. GREENE. You can not tell what you will talk about when you go to the telephone. I know I could not.

The CHAIRMAN. We have laws against murder, and yet we still have murder; and I suppose we would have violations of the law then just the same as we have now. But I am talking about the only possible practical way, as I see it now, to get at it at all would be to punish anyone sending a message in violation of law.

Mr. ROWE. They had very nearly the same condition in Europe when this war broke out. All along the German and Belgium lines were telephones that ran right across the lines, and they had telephones on both sides of the line. I presume they have all been cut since war broke out.

The CHAIRMAN. Of course, or else taken over by the Governments.

Mr. ROWE. Or else taken over by the Governments. But they had the same difficulty for a few days.

The CHAIRMAN. Yes; but they seem to be pretty well sealed up now.

Mr. SARNOFF. There was a question asked by one of the members of the committee this morning of Commander Todd as to what would happen if the Navy did take over all this wireless business; that is to say, what would happen to the commercial ships. The answer was not clear to me. Suppose the naval coastal stations handled all the commercial business of the commercial coastal stations, and a commercial ship called a naval radio station at the same time a battleship called the naval radio station; what ship is the naval station going to answer first? Mark you, I am now referring to times of peace. What ship will the naval station answer first? I know what I would do if I was a naval operator. I would answer the battleship first and let the commercial ship wait. Naval business would take precedence over commercial business at all times. But at the present time the battleship can communicate with the naval station and the commercial ship can communicate with the commercial station provided both use different wave lengths, as is the case. This, to my mind, is the answer to Congressman Greene's question.

If there are any other questions, gentlemen, I would be very glad to give you the answers if I can.

**SUPPLEMENTAL STATEMENT OF MR. JOHN L. HOGAN, JR.,
REPRESENTING NATIONAL ELECTRIC SIGNALING CO.**

Mr. HOGAN. I will endeavor to make this strictly a surrebuttal statement, and to take up only points developed by the several recent witnesses which were new and not touched upon by the opponents in their arguments against the bill. Furthermore, I will try not to bring up any new features which would require answer by the proponents, and will merely explain some of those which have come up.

With regard to the testimony of Dr. De Forest: He asked an extension of the present bill so as to provide for radiotelephony, and advocated the purchase of coastal radio stations, but not the purchase of high-power or point-to-point stations as proposed by the Government.

He said that the wireless telephone was developing satisfactorily under the present law, and that it was getting along well; but that it would be tremendously handicapped in its growth by the enactment of the present bill into law. I think that is an interesting example of what has been testified to as the stifling influence this proposed bill would exert on the development of the art, and as to its future harmful effects. Every one of the witnesses for the opponents have come in and said they see the harmful effects. Here is Dr. De Forest

saying the Navy should not purchase and operate and own the high-power stations, because the high-power stations are growing and must be in the hands of the commercial companies in order to develop. Those are substantially his words. And that is in line with Mr. Ewing's testimony, and shows the well-defined understanding of the general proposition that the growth of the art must be in the hands of the commercial interests. The ship and shore communication is still growing. Dr. De Forest said that in the next five years continuous wave transmitters would be installed on all the ships, and Mr. Clark has said as much, and I agree with him. And we who are familiar with the growth of the art every day see this constant change in even the ship stations, and therefore believe that they should be allowed to continue in the hands of the commercial companies.

Why, then, if that is so and, as Dr. De Forest said, if a growing art should be left to commercial development, why did Dr. De Forest recommend that the coastal stations should be taken over, that the coastal stations for ship communication should be taken over by the Government? Because, he said, he did not concern himself with the growth of the stations, but they would give better service if the Government owned them, and there would be less interference. And how did he justify that statement and on what basis did he make it? That the Government wave lengths would become available for the ship service; that is to say, that the present restriction which requires ships to operate on 600 meters, 300 meters, and 1,800 meters (the impracticable wave length) would be set aside if the Government owned the ship and shore stations. Now, that cannot be done under the London convention. Even though the Government owns the shore stations, it must carry on the commercial message traffic of the ships on the wave lengths specified by the London convention. And therefore Dr. De Forest's premises are in error unless the London convention be abrogated, as he recommended. And if the London convention be abrogated, and if the ship communication business consequently can be carried on on wave lengths other than 600 meters, then the commercial companies are in a position to use the different wave lengths and give a better service than the Navy could, because of the large number of commercial stations, and for the other reasons I have previously outlined. So much for Dr. De Forest.

In the matter of Mr. Lowenstein's testimony, I want to point out only that he is one of the manufacturers who has profited personally by the use of the patents and expensive developments of others. He is doing that by availing himself of the act of 1910 which has already been discussed at some length. He has no stations, nothing to lose and everything to gain by the passage of this bill. He would doubtless be one of the contractors to supply the Navy Department with some of the new apparatus which Mr. Clark said would be supplied and concerning which he was questioned by Mr. Greene. The point Mr. Lowenstein made that tests could be made by using artificial antennæ rather than real wireless stations, and which Mr. Clark discussed later, is entirely beside the mark. We are entirely in accord with Mr. Lowenstein on the fact. It is a matter of fact that many of such tests can be made with artificial antennæ and it is further a matter of fact that all test which can be so made are being

made to-day by the commercial companies in that way. But the real development of the art comes from the real service needs which are shown by real use, and not by tests; that is, by the mere experimental work of manufacturers, whether the antennæ used be artificial or real. And the incentive for carrying on practical tests in the commercial service can not exist unless the companies can use their own apparatus in radiotelegraphy. The profitable field for the commercial interests is not the mere manufacturing of commercial apparatus and its subsequent sale, but it is the sale of radio service, the transmission of messages, and so on.

With regard to Mr. Marshall's testimony—you will note I am classifying all these witnesses as proponents of the bill, which they were in fact—Mr. Marshall said the coastal wireless stations were not valuable and that it would not cost the Government millions of dollars to pay for them. Mr. Todd estimated the price at \$400,000, as I remember it. Both of these estimates are based on the scrap valuation of the material in the stations. They involve no consideration of the cost of developing those stations or of the stations' service value, nor the patent rights, the good will, nor the future worth of the station, but only what might at present or in the future be the scrap values of the material. This is manifestly a proposition of confiscation.

Mr. Cohen testified that under Government ownership the art in the future would not be stifled. Why not? Because with the art in its present condition of competitive endeavor he himself had succeeded in selling a license for a single patent to the Navy Department and was working on a second patent for them. It is obvious that no such conclusion can follow from any such premise.

Taking up Mr. Clark's testimony, I would like to say that he has substantiated practically all of the contentions which were advanced by me, and particularly these: First, that the interference which was complained of so bitterly by the Navy Department can be eliminated by suitable apparatus and by apparatus which has already been developed. We have an example of that in the concrete case stated by Mr. Clark. The commercial stations are no longer making interference with the navy yard. He states that this has been completely eliminated by a change of apparatus, and not by a radical change of apparatus, but by the mere adoption of something which they already had. And he said if they would put in such apparatus, and spend the money for such apparatus, they could solve the interference difficulty. That throws out completely the arguments which were urged for the passage of this bill and its enactment into law, for the purpose of helping the art by cutting out interference.

The second most notable confirmation of my statement given by Mr. Clark's testimony is that the regulations of the present law are sufficient for all needs. He went into that at some length in answer to questions by members of the committee, and his idea seemed to be that the only harmful point in the present law was the wave-length limitation and the nearest station requirement which flow from the London convention and which can not be overcome without abrogating the London convention (or until a new convention changes those requirements).

Now, there were some questions. I think Mr. Edmonds asked the questions as to the giving of bonds by the commercial companies for

the protection of the Navy Department in the matter of suits for infringement of patents. That matter has been looked up, and it is reported to me that the bond supplied by the contractor on each contract covers only 25 per cent of the contract price, and is filed for the purpose of guaranteeing delivery and of meeting the specifications of the Navy Department; that is to say, it is not a bond filed for the purpose of securing the Government against patent-infringement suits. Now, there are some legal points in there upon which I am not competent to go into in detail. The naval contract has a clause which specifies that there shall be some protection against patent-infringement suits brought by manufacturers, but, as I understand it, the bonding companies have ignored that and the Navy has been accepting bonds which do not protect them in that way. An example of that was given by Gen. Griggs in connection with the Simon litigation, which has been discussed, wherein Mr. Simon confessed to the infringement for the purposes of the suit. It is obvious that no bonding company would give Mr. Simon a bond guaranteeing that his apparatus did not infringe the patents in question for any contract subsequent to the one in litigation wherein he confessed to infringement.

Further, a point of practical importance is the matter of Court of Claims suit brought by the Marconi Co. at the present time. They are suing the Navy Department for damages covering a vast number of contracts—some 50 contracts—which, I understand, date back over a period of the past five years. I venture to say that if the Marconi Co. wins the suit the bonds which accompany those contracts will have expired and the Navy Department will be unable to make any recovery from the bonding companies, or the Government will be unable to make any recovery on the bonds, which “were given to protect the Government in the matter of infringement suits.”

Mr. Clark commented on the heterodyne receiver, the receiver which has been developed by the National Co. I merely wish to emphasize that the first showing of that receiver was made to the Government by the National Electric Signaling Co. in 1912, and that it has been developed largely since that time both by ourselves and by infringing manufacturers. It has been developed largely in its detail, but, as Mr. Todd testified before this committee, the principle is the same. The principle conceived by Fessenden and developed by us is exactly the same now as it was in the beginning. And, moreover, we have demonstrated our newer (and more improved in detail) forms to the Navy Department, and have proved that they are superior to the forms manufactured by De Forest and other infringers, and also to those which the Navy Department itself manufactures. And, as a recognition of that fact, about which one of the members of the committee made inquiry, I may state that the Marconi Co. is using that receiver and is paying us for it under a patent license. There are other suits for infringement that are pending on that point, and there are negotiations for licenses pending, so that the device is recognized as belonging to us, but not by the Navy.

As to Commander Todd's testimony. He said that all the companies wanted to sell their coastal stations, but would not admit it because if they did they would thereby fix a low valuation. Mr. Sarnoff has commented on that with respect to the Marconi Co. and

I wish to make an equally flat statement with regard to the National Electric Signaling Co. The statement of Mr. Todd can not be sustained.

The CHAIRMAN. What are the relations between your company and the Marconi Co.?

Mr. HOGAN. I am coming to that. It is a matter of patent license.

To resume, we must have the shore stations for our service. The New England Steamship Co., for whom we operate some 10 ships, relies on our service, which we give as a part of the contract and which the Navy could not give them if it took over the commercial Stations. We could not maintain that ship service if we did not maintain the shore stations in connection with it. We do not want to sell our stations and, as Mr. Sarnoff said for the Marconi Co., we will not sell them unless forced to do so.

Mr. Todd said the National Electric Signaling Co. had been opposed to any regulation whatever. I wish to deny that. I think the statements I have made on behalf of the company, both in my previous testimony and in my testimony to-day, are a sufficient contradiction.

Mr. Todd said that the National Co. had not progressed in the past four or five years; had made no progress in the technical field. That may be so, in so far as he is informed; but it certainly is not the fact. He said that we had never perfected certain apparatus. I venture to say we nor the Navy nor anyone else will ever "perfect" any apparatus. It can not be done. He said our claims were unfulfilled. The matter of perfecting apparatus and of fulfilling claims is all one of degree. I think nobody will deny that the apparatus which we make now and which other companies make now is far in advance of that which was manufactured even two years ago. Fulfilling claims means coming nearer and nearer to the ideal, but not reaching the ideal immediately.

Now I would like to put in the record some few lines of development in which the National Electric Signaling Co. has made material progress in the last four or five years. The first of those is the heterodyne receiver, already commented upon.

The second is the method of tone tuning, or group tuning, for the purpose of getting a combination lock effect and operating a larger number of stations in a given zone, more than can be done by mere wave length tuning. I discussed that in brief in my earlier testimony.

The third point is the matter of multiplex working; that is to say, the simultaneous transmission of a number of messages from a single station or between single pair of stations. It is the operation of two stations for the simultaneous transmission or sending of a number of messages between the same two stations. That is what we call a multiplex process.

The fourth line of development is in the matter of secrecy of transmission, i. e., the transmission of messages in such form and by such methods that they can not be intercepted. This is to prevent the necessity of using coded messages in order to insure secrecy.

The fifth line is that of high-speed working, automatic working, for the transmission and reception of messages at the speeds higher than can be maintained by the manual operation of the station for

the ordinary radio message. Automatic transmitters and automatic recorders are used in combination, so that a message can be transmitted, instead of at a rate of 20 or 25 words a minute, by hand, at the rate of from 80 to 200 words or even higher speeds per minute. This, of course, means a tremendous increase in the traffic possibilities.

The sixth line is that of the continuous-wave generators. We have made material progress on that in the last five years and we are now, in our newest stations, installing continuous-wave generators at New York and Boston for overland transmission. I venture to say that those transmitters are the last word in continuous-wave generators. Possibly "the last word" is not correct, and "latest" would be better, because the last word is not here yet.

The seventh line of development is the matter of developing the most reliable receiving instruments. The detector is a most delicate part of the receiving apparatus, and we have been making a type of new detector so superior in the matter of sensitiveness and ruggedness so it is not put out of adjustment by unusual service conditions.

The eighth line of development is the matter of the reduction of static effects, or "God-made interference" as Prof. Pupin expresses it. We have made material progress in this line, and our work to-day is far more free from static interference than it was two years ago.

There are numerous improvements of important details, such as coil manufacture and the development of types of tuning apparatus, and all such things as that. I merely cite the above as an illustration of what has been actually accomplished, and all of which can be proved and demonstrated to any member of the committee who would call at our plant; and I do this to show that the National Electric Signaling Co. is not a dead organization, as was implied by Commander Todd.

Now, as to the National Co. and Marconi patent agreement which was referred to by Commander Todd, and concerning which the chairman just questioned me: That is an exchange of licenses under specific patents in accordance with an agreement which is filed and a public document. I can furnish a copy of that if it is needed or desired. It came as a result of patent litigation in which we secured an injunction against the Marconi Co., and the Marconi Co. secured an injunction against us. That is to say, we each had the other enjoined under specific patents, and rather than prosecute litigations to a ruinous point, we exchanged licenses and arranged the payment of license fees. That is the only connection between the Marconi Co. and ourselves. Our policies are determined absolutely separately; we have no interlocking organization, and I may say our policies are radically different in many respects.

Mr. EDMONDS. You have no connection with foreign companies?

Mr. HOGAN. We have no connection whatever with any foreign company.

Mr. EDMONDS. No agreements with any foreign company?

Mr. HOGAN. No agreements with any foreign company.

Mr. EDMONDS. I do not think, Mr. Chairman, if that is the case, that the agreement in regard to patents would be of any interest to the committee.

The CHAIRMAN. No; I do not know that it would.

Mr. HOGAN. I do not believe that we even own patents of any foreign patentees. The Federal Co., for example, does; the Marconi Co. does; the Atlantic Communication Co. does; and the Goldschmidt Co. does. They have depended, in fact, very largely on foreign inventors for progress.

Mr. EDMONDS. What I am trying to get at is what operating agreements you have.

Mr. HOGAN. None other than the London International Convention, which binds everybody, of course.

I would like to point out just the fact that Commander Todd commented upon the advanced companies, as he termed them, in 1912, with reference to their attitude on the freedom of wave-length selection. And I wish to bring out the fact that the National Co. was one of the companies which in 1912 urged freedom of wave-length selection and that we urge that to-day. At that time the Navy agreed with us to the extent of asking that the international convention reserve only from 800 to 1,600 meters for military purposes rather than 600 to 1,600, and which thereby would have given the commercial companies 200 meters greater freedom in the most useful part of the wave-length range, which would have been very helpful. And I venture to say the Navy Department would have urged still greater freedom for the commercial companies had they thought it could be put over in the international convention. But the military control of that convention was well recognized at that time, and as a result even the 800 to 1,600 wave-length request was not granted. To-day they are not so liberal toward the commercial companies, as evidenced by the proposed bill and the statement that they wish to take over all commercial operations.

One other point brought out by Mr. Todd. He said the Navy discovered the traffic method of operation which involved the calling upon a single wave and thereafter changing to other waves, and that as a result they had developed the wave changer and that they were the only organization using the various changes of wave lengths. Further, that they deserve great credit for doing so, and that the commercial companies should be correspondingly censured for their own failure to take advantage of the system. The fact is that this traffic method has been advocated by exponents of the commercial companies, including myself, for at least the past eight years. The further fact is that the wave-changing device can only be used when the law permits the various organizations to use changes of wave lengths; and that, inasmuch as the commercial companies are fixed upon 600 meters and 300 meters, which is impracticable for many ships, and 1,800 meters, which is also impracticable for nearly all ships—as long as the commercial companies are forced to use those wave lengths for all their public-service business with ships it is absolutely impossible for them to take advantage of such a wave-changing method or this ordinary traffic arrangement, which has been known and desired for years.

In summarizing, I would just like to say that all the arguments of the proponents have been toward the advantages of a Government monopoly as compared to a commercial monopoly. I have pointed out, and other witnesses have pointed out, that a commercial monopoly, even if it could be effected, would be better in many

ways than a Government monopoly both for the commercial business and the development of the art itself. The difference in encouragement given inventors to better the service has been demonstrated time and time again by our big organizations and by the failure of various Governments in similar lines of activity.

Further, if a commercial monopoly ever should be formed and become harmful to the art, it could be reached and handled by the present antitrust acts. There can not be any such monopoly, however; that is to say, there can be no commercial monopoly of radio. On the other hand, you have the present bill proposing to give a monopoly to a military branch of the Government. To grant that harmful monopoly, you do not need the proposed amendment; you do not need any further bills; you need only the powers given the Navy Department by the present bill. And I will ask you to read the latter part of my previous testimony given in that connection, because there I pointed out the exact method by which such a monopoly could be effected with only the power given by the present bill.

The logical and reasonable move, so far as I can see it, for the present committee to make, is to rely upon the regulation given by the present law of 1912 and to consider the matter of extending the wave-length range; that is to say, of either abrogating the London convention or having a substitute for it by some other regulatory legislation.

If there are any questions on any of these topics, of course I would be glad to answer them.

SUPPLEMENTAL STATEMENT OF MR. FRANK B. CHAMBERS, REPRESENTING THE WIRELESS ASSOCIATION OF PENNSYLVANIA.

Mr. CHAMBERS. I fear that some of my remarks have not been taken very seriously. I was very modest in saying how far I have investigated some of this wireless work. I have heard some of the other men have referred to it as blowing my own horn, and I believe I ought to have "blowed" my horn a little more.

I have been closely in touch with the development of the art since about 1905, and, although I have represented amateur wireless associations, which might make many think my knowledge of the art was very small and was only a play way, that is not the case. I have had considerable experience with telegraphy, telephony, electric light and street railway companies and high-power companies. I have had positions, have been foreman for those various companies, and have been very successful. And I took up the wireless situation, and I have been interested, and I do not want you to think that I tried to make fun or anything like that. I merely tried to amuse you the other day along with my testimony so it would not become monotonous; that was all. But I fear I was not taken seriously.

Now, I think that I ought to make clear what I meant the other day when I referred to interference. I did not mean that I was encouraging interference at the present time, because there is a law prohibiting that. I did not mean that at all. In fact, I can bring proof from the wireless associations of Pennsylvania that I have done a lot of missionary work among the amateurs around our district to try and have them create less interference; to help them arrange

their apparatus so it would not interfere as much as it did. There was no malicious interference, but some of them were interfering, because they did not know so much about how to tune their apparatus. I have done a great deal of missionary work like that in my own time in the evenings. And I do not want you to think I was encouraging interference, because I understand there is a law prohibiting that. But I think that interference should go on so that our operators will become familiar with it, and when the time comes that an enemy brings interference to bear on us we will not be surprised at it. When you meet anything for the first time you are startled, surprised; you are not as efficient as though you had heard of it before and had had some experience with it. And if this interference would continue each and every fellow would have his own little way of coping with it and they would exchange ideas, and I think some good would result from it.

And then Mr. Lowenstein—I do not know whether he meant me or not—said it would be just as plausible to give a man a gun to go out here and shoot at people so as to get practice in marksmanship. That is not true. I am sorry, if he meant me, that he looks upon me as having such little brains. I am very sorry. But I would like to say this, and nobody will dispute this, that if a man has been under fire from the enemy and has not lost his life he is more efficient in the next battle when he goes into it than the man who is fresh. It is impracticable to shoot at that man to give him some experience in being under fire; that is not practicable at all. But he would be more efficient as a soldier and would have some experience and would not be so surprised when he went into battle if he had an idea of what he was going to meet up with.

And that is the way I think operators are. And if there is a law passed, whether I agree with it or not, I will comply with it to the letter. If I can not, I will not longer bother with the subject, as I do not wish to violate any law.

Another thing, I think Mr. Clark made a remark that I did not mean in the way he defined it. He said that I claimed that I did not have any invention, and he agrees with me that I did not. I do not know what authority he has to decide whether I am an inventor or not. I claim I have invented something and it is a benefit, and that I am able to demonstrate it is a development in the art. It is known as the Chambers double-connected aerial and ground circuit for undamped waves. It is true it embodies some previous inventions, but it is impossible at the present time to invent anything in the art of radio without its involving some former invention. I did not mean I had no invention; I meant to show the department's attitude in the way they treated me. It looked to me as if they tried to convey the idea to me, by ignoring me absolutely, that I had no invention and that I would dismiss it from my mind. But I had not dismissed it at all. That is what I meant to convey. Furthermore, they said that they had taken it up with the steam engineering department. I am very glad to know that they did. I did not know it had gotten that far; I was under the impression it had fallen into the waste basket on its way down here. He said it was not very effective because it was affected by static. Well, probably it is to some extent; but I claim if it is properly handled it is not

affected by static as much as some of the other devices they are using for the undamped signals at the present time. I except lightning; of course lightning will affect it somewhat, and the operator with it. But I want to show that I was not encouraged; that I had invented something, and I entertained their man from the Philadelphia Navy Yard, Mr. Forbes, I think his name is——

The CHAIRMAN. I do not think it is worth while to go over that matter; you have stated your position on that matter already.

Mr. CHAMBERS. I want to show I got no encouragement.

The CHAIRMAN. You have already given us to understand that was your position.

Mr. CHAMBERS. Very well; he has misinterpreted my meaning, I think.

The CHAIRMAN. Did you get any encouragement?

Mr. CHAMBERS. No, sir; I did not. He did not even write me a letter and thank me for the courtesy I had shown them. That is the least that he could have done. And in the future, should I invent something else, I will not think it is worth while for me to take it to the department, in view of the way they have treated me about this thing.

I did not want to make a big fortune; but I thought I had done something, and he need not have said it was not any good; he need not have said that. He might have said, "Mr. Chambers, this is not adapted to our needs; it won't suit us at all, but we thank you very kindly for the trouble you have taken to bring it to our attention," or something like that. Would not that have been better than saying that I had no invention, or not hearing from him at all?

The CHAIRMAN. It may be that apologies are due you.

Mr. CHAMBERS. Yes. At any time I can ever do Mr. Clark or any other gentleman a favor, should they call upon me, they will find I will do it just as cheerfully as anybody else, and I have no desire to hurt the feelings of anybody in this room. But I do not like to have the statements which I made misinterpreted, because I did not mean what he tried to show. I merely meant that a man, when he has an invention, should receive a little encouragement for some time otherwise he is apt to quit. And I am hurt on that, just hurt. Probably I ought not to feel that way, but I do.

Mr. EDMONDS. I think the committee understood what you meant to bring out, namely, the fact that if the Navy Department was running all this wireless business the inventor would not receive any encouragement.

Mr. CHAMBERS. Yes; that is the way I intended that remark; that from the way I was treated, I had the impression that is the way they would treat everyone. And I think I have a perfect right to think that.

SUPPLEMENTAL STATEMENT OF MR. GEORGE S. DAVIS, GENERAL SUPERINTENDENT WIRELESS TELEGRAPHY DEPARTMENT UNITED FRUIT CO.

Mr. DAVIS. Mr. Chairman, in view of Commander Todd's statement, I had perhaps better clarify my remarks of a day or two ago.

In referring to the wave-length limitations, I was speaking more

particularly with reference to the work to and from ships at sea. The law, I believe, defines "general public correspondence" as correspondence from a ship to a shore station and vice versa. It also provides that such correspondence must be on 300 meters, 600 meters, or 1,800 meters. With the spark apparatus, 300 meters is not entirely practicable on all ships for the same reason the 1,800-meter wave lengths are not entirely practicable on all ships. Therefore it narrows down to the 600-meter wave length for the handling of general public correspondence which is principally, and in a good many cases, the only correspondence handled by ships. I was referring particularly to the limitations in the act of 1912, and the London convention in that regard.

So far as using the 600-meter length for communication between New Orleans and Swan Island is concerned, we do use other wave lengths and I do not want to leave the impression with the committee that we were not aware of the fact that other wave lengths could be used for communication between fixed points. For communication between Swan Island and New Orleans we could not use 600 meters, for the reason it would be impossible to get enough power to communicate on that wave length owing to the distance between New Orleans and Swan Island. The London convention provides, I believe, that the Government shall exercise its own discretion in the matter of fixing wave lengths for communication between fixed points; and the Secretary of Commerce, of course carrying out those regulations, permitted us to use, and we do use, wave lengths other than 300, 600, and 1,800 meters for communication between Swan Island and New Orleans, or between any fixed point. But the point I was making was, that congestion of traffic, resulting in interference, is caused by all ships having to handle general public correspondence on one wave length other than that used between fixed points.

(Thereupon the committee adjourned until to-morrow, Friday, January 26, 1917, at 10 o'clock a. m.)

RADIO COMMUNICATION.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON THE MERCHANT MARINE AND FISHERIES,
Washington, January 26, 1917.

The committee met at 10 o'clock a. m., Hon. Joshua W. Alexander (chairman) presiding.

STATEMENT OF HON. J. K. KALANIANA'OLE, DELEGATE IN CONGRESS FROM THE TERRITORY OF HAWAII.

Mr. KALANIANA'OLE. Mr. Chairman and gentlemen, the people of the Hawaiian Islands will be vitally affected by the passage of this proposed bill.

The Hawaiian Islands, as a group, are in an isolated location in the north Pacific Ocean, approximately 2,000 miles from San Francisco and 4,500 miles from Japan. The city of Honolulu, on the island of Oahu, and which has been aptly termed "The Crossroads of the Pacific," is the American business, traffic, and military center of the Pacific Ocean. The islands manifestly can not be self-contained, by reason of their isolated position and the distance from the mainland. Their industrial activities, therefore, are dependent entirely on water transportation, so far as the actual movement of persons and commodities is concerned, both between the mainland and between the various islands of the group. Like every community far distant from the usual sources of supply, the islands are dependent one on the other to such a great degree that facility and reliability of communication between them is absolutely essential. This economic necessity was realized many years ago, in the pioneer days of the commercial and political development of the islands. As early as the late eighties efforts calling for the expenditure of large sums of money and for infinite labor and courage were made to connect some of the islands by submarine cable, but without practical success. Upon the failure of the interisland cables, and with the realization that such form of communication at that time was impracticable, the installation of a means of communication by radio telegraph was initiated and eventually carried to a successful and splendid accomplishment. The details of the development of wireless communication in the islands will be given the committee in full by Mr. John A. Balch, who is present and who has been identified with radio telegraphy in the Hawaiian Islands since the early days of that enterprise.

It is my earnest wish and effort to impress on this committee the tremendous importance of the wireless to the development of Hawaii. The growth of my country, socially, politically, and commercially, has been inseparably bound up with the development, the progress,

and the success of the wireless as an effective means of communication. Without the wireless the remarkable progress which has been made by Hawaii would not have been accomplished. Had it not been for the faith, the daring, and the tireless industry of the men who are primarily responsible for the superbly efficient system which is at present in operation, Hawaii would not to-day stand, as it does, a splendid outpost of American civilization and American ideals.

I have received many radiograms from business organizations and business men in Hawaii protesting against the passage of this bill, a few of which I should like to read, and then have them all incorporated in the record. The first radiogram which I will read is from the Chamber of Commerce of Honolulu, addressed to myself, as follows:

Wireless bills providing for regulation of radio, if become law, will be detrimental to and seriously interfere with our only interisland telegraphic intercourse and impair mainland communication. Request you strongly protest against passage of bills in interest of entire community of Hawaii.

Another radiogram addressed to me from a business firm reads:

Respectfully protest against Senate bill 7478 restricting operation of radio stations. This community's isolated position and insular formation of several island units makes radio communication an indispensable necessity, and in view of the fact that Hawaii was operating wireless communication between islands five years before the Federal Government owned a wireless station we protest against legislation calculated to eliminate what has grown to be a business enterprise of considerable magnitude, a business necessity of great public convenience. Believe our geographical position warrants Hawaii being excluded from operation of proposed law.

I will not take up your time to read these other radiograms, but file them for the record.

The CHAIRMAN. If there is no objection, they may be incorporated in the record.

Mr. KALANIANA'OLE. As representing the people of that Territory, I urge that you consider the wireless interests in Hawaii. I do not suppose anybody has appeared before this committee and touched on the wireless situation in Hawaii at all. In fact, I think some of the naval men who are in favor of this bill might be able to learn a good deal from what we have done in the way of developing wireless communication. Mr. Balch, who has come on from Hawaii to be heard on this bill, is present this morning and will be able to give you a great deal more information than I can. I do not know anything about the technical side of wireless telegraphy; but only with the great benefits which are derived by our people as a whole, so far as this means of communication is concerned. I would be glad to have the committee hear Mr. Balch at this time.

(The radiograms submitted for the record by Mr. Kalaniana'ole are as follows:)

HONOLULU.

KALANIANA'OLE,
Washington, D. C.:

We respectfully but strongly protest against the passage of Senate bill 7478 and House bill 19350 relating to wireless telegraphy, for many provisions of this bill seriously threaten the very efficient and adequate service now maintained between these islands and the mainland, also shipping and interisland communication, all of which is of vital importance to business and general life of these islands.

CASTILE & COOKE.

HONOLULU.

KALANIANA'OLE,
Washington, D. C.:

With reference to Senate bill 7478 and House bill 19350 providing for the regulation of radio communication, we strongly protest against the passage of the proposed measure, for the reasons that the local wireless company has given exceedingly satisfactory service, especially in the interisland telegraphic intercourse. The local company being the pioneers in the business and having made telegraphic communications between the islands possible deserve in recognition thereof proper and adequate protection, but aside therefrom any discriminatory legislation would prove a serious setback to the entire community

H. HACKFELD Co.

HILO, HAWAII.

KALANIANA'OLE,
Delegate Congress, Hawaii, Washington:

If wireless communication of Hawaii is curtailed by Senate bill 7478 and House bill 19350 have hearing delayed. Await protest.

BOARD OF TRADE.

HONOLULU.

KALANIANA'OLE,
Washington, D. C.:

Radio bills before Congress are greatly detrimental to interisland communication. Provisions for fixing maximum interference of ship stations will likewise interfere with local messages and also very seriously impair or destroy the value of a greater part of the local apparatus for any purpose. We strongly protest against same and urge you to oppose.

INTERISLAND STEAM NAVIGATION Co.

HONOLULU.

KALANIANA'OLE,
Washington, D. C.:

We strongly protest against proposed measures to govern wireless telegraphy. Will affect rapid communication, which is absolutely necessary in exchange of commercial business.

HIND ROLPH & Co.

HONOLULU.

KALANIANA'OLE,
Washington, D. C.:

Wish to join the local unanimous protest against wireless bill. Consider it in all probability costly to interruption of island business.

WALDRON,
Agents Great Northern Pacific Steamship Co.

HONOLULU.

KALANIANA'OLE, *Washington, D. C.:*

Senate Bill 7478 and House bill 19350 if passed will be extremely detrimental to all island business interests, as it will destroy the only speedy means of interisland communication which we have enjoyed for the past 15 years. On behalf of ourselves and our constituents we join with others in voicing our protest against the passage of these bills.

ALEXANDER & BALDWIN.

WAILUKU, MAUI.

Delegate KALANIANA'OLE, *Washington, D. C.:*

If possible have action deferred on Senate bill 7478 and House bill 19350 until Hawaii can be heard.

MAUI CHAMBER OF COMMERCE.

HONOLULU.

KALANIANA'OLE, *Washington*:

House bill 19350 and Senate bill 7478 are exceedingly injurious to Hawaii. Interferes with wireless communication. Hearing on House bill to-morrow. Request you have hearing deferred pending receipt of our formal protest by mail.

CHAMBER OF COMMERCE.

LIHUE, KAUAI.

KALANIANA'OLE, *Washington*:

Have House bill 19350, relating to wireless communication, deferred until receipt of mail particulars.

KAUAI CHAMBER OF COMMERCE.

HILO, HAWAII.

KALANIANA'OLE, *Washington*:

We protest against that portion of section 24 of House bill 19350 which curtails our present allotment of time for commercial communication; also protest any action that will retard development of wireless telephony.

BOARD OF TRADE.

HONOLULU, *January 29*.KALANIANA'OLE, *Washington*:

Maui Chamber of Commerce protests against the passage by Congress of any measure that will tend to interrupt or decrease the efficiency of the present wireless service in Hawaii or increase the existing wireless rates.

STATEMENT OF MR. JOHN A. BALCH, TREASURER OF THE MUTUAL TELEPHONE CO. OF HAWAII AND SUPERINTENDENT OF THE WIRELESS DEPARTMENT OF THE COMPANY.

The CHAIRMAN. Give the committee your name and business connections.

Mr. BALCH. John A. Balch. I am treasurer of the Mutual Telephone Co. of Hawaii and superintendent of the wireless department of that company.

The CHAIRMAN. Is that an incorporated company?

Mr. BALCH. An incorporated company, operating under the laws of Hawaii.

The CHAIRMAN. Who are the officers of the company?

Mr. BALCH. E. F. Bishop is the president; Mr. C. H. Atherton is the first vice president; J. R. Galt, second vice president; J. A. Balch, treasurer; John Waterhouse, secretary. These men, together with R. A. Cooke and George Rodiek, constitute the board of directors.

The CHAIRMAN. Are they all residents of Honolulu or the Hawaiian Islands?

Mr. BALCH. All residents of Honolulu and citizens of the Territory of Hawaii.

The CHAIRMAN. Is the stock of that company held there?

Mr. BALCH. It is practically all held in the Hawaiian Islands.

The CHAIRMAN. You may proceed in your own way, Mr. Balch.

Mr. BALCH. I think it would be necessary, in order to appreciate the importance of radio communication on the islands, to give a brief history of the early development in both cable and radiotelegraphy.

The first attempt at connecting up the various islands composing the Territory of Hawaii with a suitable means of rapid communication occurred in the year 1889, when a local Hawaiian company was organized under the then "Kingdom of Hawaii," and a cable laid between the island of Oahu, on which Honolulu is situated, and the island of Molokai, it being the intention of the company to extend the same as soon as practicable so as to include the islands of Maui and Hawaii within its scope. Unfortunately, however, both for the company and the public the Kaiwa or Molokai Channel, separating Oahu from Molokai proved both too deep, too rough, and too rocky; and shortly after the first message was flashed from Molokai to Honolulu, the cable parted and communication was interrupted. During the following year the cable was fished, spliced, and relaid after considerable expense and delay; but it was soon ascertained that either the same was not suitable or had been so poorly spliced that its conductivity had been ruined.

Communication, therefore, being impossible, the company failed and the whole project, including the cable, was abandoned as being impracticable.

Before passing from the subject of cable installation, however, it might be well to submit a few brief facts bearing on the difficulties of either submarine telephony or telegraphy between the islands of the group and how this fact, in turn, drew the attention of Marconi to the Hawaiian fields with wireless as a solution, as early as the year 1899.

Of the Hawaiian group, eight are inhabited. Of the five principal islands Hawaii is the largest area, 4,015 square miles. The islands extend in a general northwest and southeast direction, and the channels separating them are of various widths and depths of water, as follows: Kaieie Waho Channel, between Kauai and Oahu—shortest distance, 72.16 statute miles; its deepest known depth is 11,232 feet. Kaiwi Channel, separating Oahu and Molokai—shortest distance, 26.89 statute miles; its deepest known depth is 2,214 feet. Pailolo Channel, separating Molokai from Maui—shortest distance, 9.09 miles; its deepest known depth is 840 feet. Alenuihaha Channel, separating Maui from Hawaii—shortest distance, 28.79 statute miles; its deepest known depth is 7,560 feet. To add to the difficulties of bridging these long distances and tremendous depths of water is the fact that all the islands are surrounded by coral reefs and high surf, thereby necessitating the use of heavily armored cables in all landings from sea to shore.

RADIO TELEGRAPHY DURING THE YEARS 1899 TO 1907.

Ten years after the successful attempt of interisland cable telegraphy, F. J. Cross, an electrical engineer of Honolulu, became convinced that a solution of the difficulties and excessive expense in bridging the channels of the Territory by cable had been found in the then practically untried inventions of Signor Marconi. With this in mind, he journeyed to New York City in September, 1899, to meet Mr. Marconi, who was then engaged in demonstrating his invention by reporting the results of the international yacht races off New York Harbor. Before going, however, he had communicated with Marconi, in London, and had drawn to his attention the urgent

need of Hawaiian interisland communication. On reaching San Francisco he received a cable from Marconi, then in New York, not to come on, as he could not sell the right for Hawaii, unless he (Cross) would buy the entire patent rights for the whole United States. Cross persisted, nevertheless, and on the 31st day of October, 1899, signed a contract with Marconi for complete installations to connect the five larger islands—Kauai, Oahu, Molokai, Maui, and Hawaii. The contract called for men to arrive in Hawaii not later than February, 1900, to effect the installations; but, owing to bubonic plague having broken out in Honolulu, the Marconi people did not send their men out until April, 1900, at which time three experts arrived and proceeded to erect masts and install stations at places designated by them. The first station was erected at Kaimuki, now a suburb of Honolulu, and the second at Keomuka, island of Lanai.

On the completion of these stations an attempt was made to communicate between the two; but without success. Another station was then installed at Laau Point, island of Molokai, which was located about half way between the first two stations. Communication was again attempted between the stations now supposed to be in order, but still without result. Then, simultaneously, two stations were erected and equipped, one at Millers Hill, Makena, island of Maui, and one at Mahukona, island of Hawaii; but no communication could be established.

Cross then cabled the Marconi Co.: "Four stations now erected, but a complete failure. Advise." To this cablegram a reply was received, reading, "Marconi wireless must work. Mr. Gray, the most competent, will sail for Hawaii immediately." At this time there was no cable communication between Hawaii and the mainland, the commercial Pacific cable not having been laid, so that both of the above cablegrams were mailed between San Francisco and Hawaii.

Expert Gray arrived during November, 1900, and at once proceeded to experiment with a kite on the beach at Waialae (near Maikiki, Honolulu), in an endeavor to work the Molokai station. This being successful, the station at Kaimuki was shifted to a point on the sand beach at Waialae, where suitable salt water ground connections could be obtained.

At this point, owing to the failure of the first installations, the stockholders of the Interisland Telegraph Co., to whom Cross had sold his contract with Marconi, became nervous and lost confidence in the system ever becoming a success, as did the whole population generally. And in consequence of their timidity, together with the fact that the annexation boom, with which Honolulu had been inflated, suddenly burst, and as only the first assessment of 15 per cent had been paid in cash on their stock, four-fifths of the stockholders positively refused to pay more, thus crippling the undertaking financially, as the company was already in debt and the changes insisted on by Gray were costing money. After shifting the station on Maui, a half-hearted sort of communication was established between Oahu and Hawaii, by relaying through the intermediate stations of Molokai, Lanai, and Maui. Here the Marconi Co., through Mr. Gray, demanded the last payment on account as per contract;

but as said contract called for a satisfactory system, which they did not have, coupled with the fact that no money was in the treasury of the local company, it was found impossible to accede to his request. The history of the organization from that time on is separate from the Marconi Co. It was resumed again by a working contract with the Marconi Co. of America in 1912.

Mr. RODENBERG. I would like to make an observation right there. I was on the island of Hawaii, at Hilo, in the spring of 1901, when they got over the first message by wireless. I remember the excitement there, and I remember the message very well. The message was "Paul Newman died last night." That came by wireless in the spring of 1901. In the spring of 1901 they made the connection and got across the first communication from Honolulu to Hilo.

Mr. BALCH. I expected to bring that out later. On the 1st day of March, 1901, the line of stations opened for business, and while on some days they succeeded in transmitting messages promptly, on others, owing to defects incidental to the then long distances traversed and pioneer working, nothing was received or transmitted. Naturally such an intermittent service soon caused the people who used it, or, rather, who attempted to use it, to put no dependence in it whatever. After a few months' use the coherers (the form of detector then used) played out; and, owing to the disagreement with the Marconi Co., they were unable to purchase renewals, thus necessitating the closing of the system, until after some months of experimenting a new supply of coherer tubes were manufactured by Cross, from which signals could be recorded.

At this period the business men of Honolulu came to the rescue of the company with an offer to guarantee about \$1,000 per month in business, and under this arrangement the service was continued in operation for about 15 months, or until the Territorial legislature of the year 1903, realizing the importance to the Territory of inter-island communication, granted a subsidy of \$1,000 per month for 24 months, on condition that the company would connect up the island of Kauai, which had as yet not been done, reduce its rates, and build a telegraph line between its Hawaii station and the city of Hilo. In the first attempt to connect up the island of Kauai a station was erected at Nawiliwili, Kauai, and another at Kaena, the most western point on the island of Oahu. Every effort was made to get these two stations in communication, but without avail, so, therefore, in order to simplify the entire system and to give better service with fewer stations, the station at Kaena Point was shifted to Barbers Point, where communication was immediately opened up with Kauai, although the distance was increased over the first attempt about 20 miles. The reason for the failure to connect Kaena Point with Nawiliwili was attributed by Cross to the high lands just back of the Kaena Point station. The Waianae Mountains came down in very close proximity to the masts of the station, and he attributed the fact that while the station at Kaena Point could send to Nawiliwili and messages from Nawiliwili could not be received at Kaena to the effects of these mountains wafting the signals over his masts, and insisted on the station being moved to Barbers Point. That was in 1904. Some years afterwards, when I took charge of the system, I happened to overhaul an old coherer set used at Kaena Point and

I found there a piece of iron, or a screw, that had gotten behind the wooden case and gone through a certain little condenser. This was the cause of the failure. It was concealed underneath and had not been found.

From Barbers Point, also, they were in communication with the stations on Molokai Point and Lanai. This arrangement relieved the stations at Waialae and Molokai, so the former was moved to Lahaina, Maui, where communication was at once established with it direct from Barbers Point, Oahu. In attempting to work direct from Lahaina, Maui, to the Hawaii station at Mahukona it was ascertained this was impossible owing to the interposition of the high mountains at Makena Point, Maui.

The station at Laau Point, Molokai, was then shifted to Puako, Hawaii, as this site offered a direct water communication without screening of the land between the island of Oahu and the Barbers Point station on Oahu, as well as the Lahaina station on Maui; and on its completion communication was immediately established with Barbers Point by relay with Lahaina, a distance of over 172 miles, which, considering the date, January, 1904, was excellent daylight working. In fact, at that time it was almost the record. After moving the station from the island of Lanai to Kamalo, Molokai, the line of stations then consisted as follows: Nawiliwili, Kauai; Barbers Point, Oahu; Kamalo, Molokai; Lahaina, Maui; and Puako, Hawaii, and remained in these sites until comparatively recent years.

The legislature of the year 1905, declining to resubsidize the company, it therefore failed and went into bankruptcy and was sold on the steps of the capitol building at Honolulu on January 9, 1906, to satisfy the claims of its many creditors. The system was bid in by F. J. Cross and associates and reincorporated under the name of the Wireless Telegraph Co., and on June 1, 1907, C. J. Hutchins, J. A. Balch and associates became the purchasers for the sum of \$50,000 in cash of the controlling stock interests from Cross, and proceeded to thoroughly rehabilitate the system, which was then in a badly run down and delapidated condition.

On reviewing the early history of radio in Hawaii one wonders at the numerous times stations were removed to different locations and the reasons therefor; and when the difficulties of these removals are considered—the landing in small boats in the surf in isolated localities, in one instance over 30 miles from the nearest steamer landing and inhabitants—that was on the end of the island of Molokai. They had to land all their masts through the surf; even the water was carried by ship from Honolulu, and also landed through the surf, and special steamers had often to be chartered in order to make the trip. On many of the other islands the conditions were even worse than at Laau Point. As I say, when the difficulties of these removals are considered, the huge expense in dragging the heavy wooden ship masts over the coral reefs and erecting same, together with building and the thousand and one details that had to be attended to in each instance, one can not help wondering at the perseverance and faith of these early experimenters in Hawaii, who carried out to a successful conclusion a series of experiments in a science that was at that time practically unknown throughout the United States. On look-

ing back from the present status of the art and reviewing these early operations one is apt, of course, to forget how these men were groping in the dark and that their great bugbear—mountain screening—was principally caused by improper and old-fashioned receiving instruments and lack of sufficient transmitting power.

I might say that at that time, working as they did, they had the old Marconi coherer system for receiving, and they were working a 10-inch coil direct connected to the ground and aerial for transmitting. These coils in most instances were furnished power by dry batteries, and it sometimes took a barrel or so in parallel to furnish enough power to produce a spark of sufficient size to carry across the channels. It is rather difficult to ascertain just how much was spent in these efforts, which were finally crowned by success. But from figures submitted by Cross and others I believe the amount was not far from \$125,000 in all. The years between 1907 and 1912, on my taking charge of the system, the total monthly income was approximately \$1,600, out of which the running expenses of \$1,000 had to be deducted, leaving \$600 monthly to meet depreciation and the building of the first high-powered ship station, it being then apparent that in a short time many ships would be equipped. And as the United Wireless Telegraph Co. was not only equipping these vessels, but was selling its stock certificates throughout the Territory, it was also realized that if the local company was to keep its field of operation it should build as powerful ship to shore stations as was possible. During the early part of the year 1908 the company engaged the services of A. A. Isbell, an expert radio engineer, who after a careful search for a suitable site for the station decided on Kahuku Point, Oahu, a location which offered a free water communication, east, north, and west, and was as well a low-lying, sandy promontory, extending out from the high mountain ranges of Oahu.

In May, 1908, this station was started and was completed and placed in operation on October 15, 1908. It was a full 10-kilowatt equipment and was at that time one of the strongest, if not the strongest, station on the Pacific. For some weeks prior to the completing of the transmitting equipment of the new plant, Mr. Isbell, on listening in at nights, had heard with unusual clearness the United Wireless station located on Telegraph Hill, San Francisco. So that on the completion of the station, on the evening of October 15, it was not a great surprise for those connected with the company to immediately open up a night communication with the San Francisco station—a distance of 2,100 miles. This was the first direct radio communication that had ever been established between Hawaii and the mainland, and was a record of long distance working at that period.

The CHAIRMAN. That was in October, 1908?

Mr. BALCH. October 15, 1908. During the following year the Barbers Point station was abandoned and its equipment moved to Kahuku, a change that was greatly appreciated by the operators, as the Barbers Point site was an inaccessible location 5 miles from the railroad and with no fresh water other than what could be caught during occasional rainstorms. It is surprising, when we think back, how those operators at that period managed to exist at some of those stations. Most of the water they had to drink was brackish and in

many instances they did not have enough to cook with. And yet those men stayed at their stations and worked along until the final success of the system. Many of them are still employees of the company.

AMALGAMATION WITH THE MUTUAL TELEGRAPH COMPANY.

During the early part of the year 1909 C. J. Hutchins, president of the Wireless Co., had secured from the Automatic Electric Co., of Chicago, the sales rights to their automatic telephone system for the Territory of Hawaii, and had interested Honolulu capital in the proposition of establishing in Honolulu an automatic telephone plant in opposition to the locally owned Bell system which at that time was furnishing a very indifferent service to its 1,800 subscribers. It was soon ascertained, however, that however much the Honolulu business community desired a better telephone service, they preferred the service as it was to a dual system of companies. But this agitation soon led into negotiations that ended in the purchase of the controlling interest of the stock of the Mutual Telephone Co. at its par value. The Mutual Telephone Co. was at that time capitalized for \$150,000—15,000 shares at \$10 per share, all fully paid and non-assessable. Its capitalization was raised to \$250,000 by the issuance of 10,000 new shares of stock, and the purchase of the Wireless Telegraph Co. effected by giving two shares of Mutual stock for one share of Wireless stock, the Wireless Co. being then capitalized at \$50,000—5,000 shares at \$10 per share.

After the amalgamation of these two companies a bond issue was floated for \$250,000 and the proceeds thereof expended in rehabilitating both the telephone and wireless systems. A careful inventory was made of the value of the old system that was incorporated into the new, and the difference in value between the original capitalization and that part of the plant that was still serviceable (amounting to over \$102,000) was written off to profit and loss during the years 1910, 1911, and 1912. In taking over the Mutual and establishing the automatic, we practically had to junk the entire system. We junked a total of \$102,000 of the entire system which had an original capitalization of \$150,000. Instead of doing as many companies would have done and making a capital asset of that, we wrote it off to profit and loss and thus off the books of the company.

Mr. GOODWIN. What is the total investment up to date?

Mr. BALCH. At present it is \$615,570 in stock and a bond issue of about \$360,000. I will give the figures exactly later on.

After the present radio act of August 13, 1912, was passed, a thorough renovation of the entire wireless system was made in order to comply with the provisions of that act.

On Kauai an entire new station was erected at Lihue, and the old station dismantled, and at Lahaina (Maui), Kaunakakai (Molokai), and Kawaihae (Hawaii) new apparatus was installed, all operators licensed, and a demand made of the Department of Commerce for station licenses in conformity with the new regulations. During this year an agreement was entered into with the Marconi Wireless Telegraph Co. of America by which the Mutual Wireless was able to secure the protection of the Marconi patents. This agreement is

still in effect and runs for the period of 25 years from the 20th day of September, 1912.

During the year 1913 the Marconi Wireless Co. started the erection of their trans-Pacific radio station at Kahuku within a distance of $1\frac{1}{2}$ miles of the Mutual station. And as this large station would undoubtedly have interfered with the receipt and transmission of messages by the smaller stations, the Marconi Wireless Co. very honorably moved said station to Wahiawa, Oahu, a distance of 15 miles, the site of its present location. The agreement of the Marconi Co. to undertake this removal was carried out in full by said company at an expense of approximately \$10,000. That shows how honorably the Marconi Co. has treated the Mutual Telephone Co. In looking around it found the only suitable site for its large 350-kilowatt plant was on Kahuku Point, and realizing that, it simply moved our station and paid for the expense of moving it in order to avoid interference.

LICENSING OF STATIONS.

During August, 1913, all of the stations of the company were inspected by Mr. L. R. Krumm, then chief radio inspector in the employ of the Department of Commerce; and while the inspection was satisfactory and the stations found to thoroughly pass the requirements of the law, licenses were refused—for what reason I do not know—by the Department of Commerce. And it was not until the latter part of the year 1916 that provisional licenses were received, the delay being explained by the Department of Commerce to the fact that, owing to a shortage of funds, it was impossible to send a new radio inspector to Hawaii.

OPENING UP SOUTH SEA COMMUNICATION.

During the latter part of the year 1914 our operators at Wahiawa, Oahu, had been hearing, on nights when the atmospheric conditions were favorable, the United States naval radio station at Tutuila, Samoa, as well as the station at Apia, Samoa (a British station), and during the early months of 1915 a series of tests were carried out between the naval station at Tutuila and Wahiawa with a view to ascertaining whether or not a reliable system of night communication could be established between these two points, a distance of approximately 2,400 nautical miles. By making certain changes in the equipment at Tutuila so that a large increase in radiated power was obtained, signals were soon passed between the station of an audibility that left small doubt that a commercial service was both practicable and feasible. On April 1, 1915, therefore, this was started and has been carried on successfully ever since, even during the summer months of severe static conditions.

Before the opening of this service Tutuila's only means of communication with the outside world had been by radio to Suva, Fiji; thence by cable to Vancouver, British Columbia, at a total cost per word of approximately 75 cents; whereas via Honolulu the rates were as follows: United States naval rate to Honolulu, 5 cents per word, no minimum; Mutual wireless to Honolulu, 10 cents per word, \$1 minimum.

I might add that when we wrote to the Navy Department here and stated that we had started this service and that the same was reliable, I received a communication from Capt. Bullard practically stating that such a thing was impossible. That communication over a distance of 2,400 miles with the power we were then using was practically impossible, and while it might be worked at times, he felt quite sure it could not always be depended upon. But that has proven not to be the case. The service has been reliable. It has worked, practically with the exception of five or six nights in the past two years, every night. All the Federal Government business of the United States between Tutuila and the United States, or vice versa, has for the past two years been sent over this system.

From Honolulu to San Francisco the sender was offered three routes; that is, Commercial Pacific Cable, Marconi Wireless Telegraph Co., and Federal Wireless Telegraph Co., all three companies charging the same rates, namely, 25 cents per word for rush service, no minimum charge; night letters, \$1 for 12 words and 8 cents for each additional word. A 12-word message, night letter, from Tutuila to San Francisco, via Honolulu, or vice versa, would cost—

Tutuila to Honolulu, naval rate.....	\$0. 60
Tutuila to Honolulu, Mutual rate	1. 20
Honolulu to San Francisco, C. L. T. rate.....	1. 00

or \$2.80 for 12 words, making 23 cents a word, as against 75 cents per word by going over the British cable from Suva to Vancouver, British Columbia.

Service to Apia, Samoa, and Tahiti, Society Islands: During the early part of the year 1916 the British authorities at Apia inquired by radio whether the Mutual Co. would consider establishing a commercial service to Apia, and via Apia to Tahiti, and suggested a rate of 2 shillings from Honolulu, to be divided equally between the Mutual Co. and the Apia authorities on all work to or from Apia or Tahiti, the Apia authorities stating they would take care of the French charges or all messages to or from Tahiti out of their share of the charge. This was agreed to, and a successful but limited traffic has been built up as a result.

I now wish to touch on the ship-to-shore service. As mentioned heretofore, the ship-to-shore service of the company started on the erection of its Kahuku station (later removed to Wahiawa) in 1908, at which time the only ships equipped with radio were the U. S. transports *Thomas*, *Sheridan*, and *Sherman*, the steamship *Lurline*, and the steamship *Hiloian*; and, dating from then, an excellent service has been maintained ever since, the Kahuku-Wahiawa stations being the only public ship-to-shore spark stations within the Territory. And no complaint has ever been made by the business community or others against the service rendered or the prices charged for the same. All the various radio companies owning ship equipments have been treated equitably and charged the same rate for service, namely, 10 cents per word, with a minimum of \$1, from or to any destination on the islands of Oahu, Molokai, Maui, Kauai, and Hawaii, with no additional charge for telephone or telegraph service that may be necessary in the receipt or delivery of messages from or to any of the islands covered by the interisland system.

Now, I might say that under this bill, should the Navy take over the ship-to-shore work, they would not be able to give the same service

we are offering, inasmuch as we have the interisland system and they could not receive or deliver messages throughout the Territory other than the island of Oahu.

The CHAIRMAN. The ships of the Interisland Navigation Co. are not equipped with wireless, are they?

Mr. BALCH. No, sir. But in transmitting a message from any of the islands or from a ship to any island or any island to a ship we make the same charge, although it has to be rehandled by several stations, probably.

The record of paid messages handled by the system discloses the fact that the following number of paid messages have been handled by the company for the years 1910 to 1916, inclusive, and this record does not include press messages, service messages, or deadheads, but only paid messages sent or received: For the year 1910 there were interisland messages amounting to 15,598; for 1911 the interisland messages amounted to 13,940, and the ship messages 3,305; for 1912 the interisland messages were 17,067 and the ship messages 4,269; for 1913 the interisland messages were 13,826 and ship messages 5,495; for 1914 the interisland messages were 13,638 and the ship messages 5,526; for 1915 there were 15,011 interisland messages, 5,456 ship messages, and 331 South Sea messages; and for 1916 there were 20,721 interisland messages, 6,381 ship messages, and 640 South Sea messages.

Now, I may say here that the wireless system of the Mutual Telephone Co. is merely a department of that company. Its assets and liabilities and its bookkeeping is kept separately from the telephone department and all accounts and all overhead charges are proportioned to its total capitalization in an equitable way, so that our book accounts of our net profits or net results would be an absolutely reliable source of data to establish the value of our system.

While apparently not very much is known of our system in the Capitol here, I will say that the Japanese Government has been watching our service between the islands for many years. The first engineer they sent out was an engineer by the name of Wichi Torrikata. He is now chief radio engineer in the department of communication in Japan. Mr. Torrikata made an examination of our system as early as the year 1911. During September of last year the Japanese Government, wishing to establish a system of interisland communication between the islands of Japan sent an engineer by the name of E. Yokahama to Honolulu to study our system and the methods employed there in communication between the islands. Mr. Yokahama was very much impressed with the simplicity of our service, its accuracy, and the way we handled a large amount of traffic with a limited number of men. So much impressed was Mr. Yokahama that he telegraphed to Japan a very favorable report of our system.

Mr. RODENBERG. Has your system since been adopted in Japan?

Mr. BALCH. I believe it has. As to what the business interests think of the system in the islands I can only refer to the messages radiographed at a large expense by all the shipping firms in the islands and every chamber of commerce in the Territory. They have telegraphed what they think of our system, what they believe of our service, what they think of our rates, and I can not ask any better recommendation than that.

As for the interference problem between the islands, the Wahiawa station is situated 15.4 miles from the Marconi 350-kilowatt station; it is slightly over 14 miles from the Federal station, and is 10.2 miles from the new station at Pearl Harbor. While we have had some interference in working our interisland and ship business from the larger stations, we have in the last few months practically overcome any trouble we had experienced from that source. It is possible now (and we are doing it every night of the year and every day of the year) to work simultaneously with the ships at sea or with the interisland stations, or even with Tutuila, Samoa, 2,400 miles away, while the Marconi is working 15 miles away and the Federal Co. is working 14 miles away.

The CHAIRMAN. How about the naval station?

Mr. BALCH. The naval station, with the long wave length, the high-power station, has not been started. But I honestly believe, in my own heart, that should they keep on a wave length longer than 5,000 meters, although they are only 10 miles away, we will work along without interference.

Mr. EDMONDS. Longer than 500 meters, don't you mean?

Mr. BALCH. Five thousand meters. They are all long-wave stations. Up to very recently, within the last few months, we did receive some interference from the Marconi station. The Marconi station is situated on this low-lying promontory at Kahuku, where the very high surf breaking over the reef and very heavy winds at night covered the insulators on their mast guys with a coating of salt, causing the current from the aerial to snap around these salt incrustated insulators and set up a spark that was audible in the receivers at our Wahiawa station. It was not so much the interference by the wave of the Marconi station itself as it was this sparking from the insulators on the Marconi masts. During the last few months they have been able to go over their masts carefully and those insulators that could not be replaced and sparking prevented they have shorted by passing a wire around it (shorted the insulators), so that now we are working very successfully both while they are working to Japan and while they are working to the coast. And, as I said before we are able to receive signals a distance of 2,400 miles simultaneously with the Marconi station working both the coast and Japan.

The CHAIRMAN. What is the distance to Japan?

Mr. BALCH. The distance to Japan is something like 4,000 miles.

I might say, also, that on many occasions, and particularly during the winter months we have gotten in touch, from our little Wahiawa 5-kilowatt station, with the Japanese stations on the coast of Japan. It seems almost unbelievable, but we have accomplished this on numerous occasions. We have also spoken within a space of half an hour with Japan, Tutuila, Alaska, and the station at San Francisco, the Marconi ship station at San Francisco, all within the space of half an hour—communicated, in other words, all around the Pacific Ocean.

The average distance we work our ships at present, and for the last six years, has been approximately 1,000 miles. Of course this communication has been at night. In the daytime our average distance is about 400 miles. Again I wish to call your attention to the amount of work we handle in our interisland business and the

fact our interisland system is the only means of communication between the island of the Territory. All the "press" that is sent to the other islands, as high as 1,500 words a day, is sent over our system; also the stock market quotations, movement of ships, life and death messages—every message of importance is transmitted over our system as being the only means of rapid communication.

Under section 24 of this bill there is a provision whereby, should our station interfere with the naval station the Navy is granted each alternate hour of the 24. Now it is absolutely impossible for our station at Wahiawa, 10.2 miles from the naval station, the naval station operating on the 600-meter wave length, working from shore to ship, and our station working on either shore to ship or on its 575-meter interisland wave length to keep from interfering. They would be sure to interfere. It would be absolutely impossible, no matter what apparatus was put in, to prevent that interference. So it naturally stands to reason that if such a provision as contained in section 24 were allowed to stand the Navy would call for a division of time on Oahu and with that division of time it would make it an absolute impossibility for us to conduct our service between these islands.

The CHAIRMAN. How about the Navy? Suppose the Navy wants to communicate?

Mr. BALCH. There are days when we have now as high as 3,253 words between these islands to transmit in eight hours. Now that might not seem like a large amount of business, but when you consider that in most cases we have to telephone same from our stations on the islands to addressee, and often in code, and in many cases long "press" messages of 500 words or more, stock quotations, life and death messages, and every other form of message, it all takes time. We have to telephone almost all messages, having only two telegraph stations, one connecting Honolulu with Wahiawa and the other on the island of Hawaii, where a 90-mile telegraph line connects our Hawaii station, located at Kawaihæ, with the city of Hilo, and so at most of our stations we have to stop our wireless work to telephone messages, sometimes to ascertain from half a dozen different telephones where the addressee is. It is sometimes necessary to send messages to our Delegate, for instance, and we only know he is in the Territory some place and it is up to us to find him; he may be on the island of Molokai or Oahu or any place; and we just have to look him up; that all takes time. And if we were finally to lose half of our working hours it would be impossible for us to carry on successfully the business we have at the present time.

The CHAIRMAN. How about the Navy station? Is it important that they have the privilege of utilizing their station?

Mr. BALCH. I beg pardon?

The CHAIRMAN. I say, How about the naval station? Do you think they ought to have any privileges along with the operation of your company?

Mr. BALCH. I believe that during times of peace there could not be anything, other than S O S messages, more important than the work our company is transmitting between the islands; and as such, it should have the right of way at all times over the Government.

The CHAIRMAN. And your fear, I understand, is that you can not operate your station and the Navy can not operate the Navy station at the same time; is that correct?

Mr. BALCH. I am speaking of ship-to-shore communication, on the short-wave length. No, sir.

The CHAIRMAN. And hence you think you ought to have a monopoly of all the time?

Mr. BALCH. We should have the preference right over the Navy.

The CHAIRMAN. Over the naval station?

Mr. BALCH. Yes. Other than S O S messages or possibly official messages between a naval ship and the shore. That is the way we are working at the present time and that is the way we should be able to continue.

The CHAIRMAN. We are erecting a great naval base at Pearl Harbor, are we not?

Mr. BALCH. Yes, sir.

The CHAIRMAN. And it is at Pearl Harbor this wireless installation is being made, is it not?

Mr. BALCH. I thought I explained, Mr Chairman, that our stations and the Pearl Harbor long-wave naval station, which station is to work on point to point communication, will not interfere.

The CHAIRMAN. I want you to make that clear. It is simply from shore to ship?

Mr. BALCH. Shore to ship. It is the short-wave communication.

The CHAIRMAN. Proceed.

Mr. BALCH. This interference problem is something that the more you worry over it the larger the problem becomes. Between the islands, in the operation of our system, we have a rush business to contend with; business men, brokers, and others who come into our offices and have a message to be sent to another part of our islands often sit down and ask for a reply in 10 minutes, and wait until they receive it. Now, many times we have Japanese or ships of other nationalities off the islands that are engaged in carrying on conversation between themselves. It used to be a source of great annoyance. Our operators would come to me and say "Why, it is impossible to get this message through; such and such a ship is talking," or "the Government is in with its Army radio station at Fort De Russey," or "the United States transports are talking," or sometimes "the Marconi station is in and they are interfering." The way I solved that problem was to put in the best wireless receiving equipment I could get, and then simply said to the chief operators at the stations, "You either work through that interference or I will get somebody who will get through it." And you would be astonished, gentlemen, to see how we get through interference now. If the Navy would do the same thing, put it right up to their men to get through the interference "or you lose your job," they would get through in 9 cases out of 10. You can make it as big a problem as you want to, or you can simplify it as we have done in Hawaii. You might just as well try to legislate static out of existence. You can not do it. By legislation it is impossible, and you are simply arresting legitimate development of the radio art when you try it. We get through interference in the islands; and we have carried on a large radio business successfully and we are doing it every day in the year. And this busi-

ness has not been done by sitting down and wanting to legislate everybody else out of existence.

Now, as to our interisland rates, I have here a printed schedule of rates adopted by our company on January 1, 1917:

INTERISLAND MESSAGES.

Ordinary messages, per word.....	\$0. 15
Press messages, per word.....	. 07½
Cipher or code messages, origin and destination Hawaiian Islands, per word.....	. 25
Night letters:	
First 24 words (minimum charge).....	1. 00
Each additional word.....	. 04

Cablegrams or trans-Pacific wireless messages in cipher, code, foreign or English will be accepted and forwarded at ordinary rates plus the forwarding charges of the Cable or Wireless Co., when such messages are to be delivered to them for forwarding.

Double-rush messages, which means all other traffic on the line stopped, except any previously filed double rush, and the double rush put through immediately, will be charged for at double rate.

Messages filed in any other than English will be charged for at code rate.

Night letters may be filed at any time, and will be delivered on the morning following date of filing. Night letters are not accepted for ships at sea. Night letters must be in plain language.

SHIP MESSAGES VIA WAHIAWA, OAHU, LONG-DISTANCE STATION.

Messages from ship to shore or shore to ship from or to any point on the islands of Oahu, Hawaii, Maui, Kauai, or Molokai, per word.....	\$0. 10
Minimum charge.....	¹ 1. 00
Press messages, per word.....	. 05
Minimum charge.....	¹ . 50

All messages must be sent paid from ship to shore or from shore to ship.

In all messages filed with this company for transmission the address and signature is counted and charged for.

At the time of the first commencement of the service in the islands the rate was 20 cents per word, with a minimum of \$2 for 10 words. When the legislature of 1903 granted a subsidy to the company they insisted that the company should cut its rates to 15 cents a word, with a minimum of \$1.50. Under those rates the company ran along until the past year, at which time the business had increased to such an extent that I recommended to our directors that it would possibly lead to greater business and greater profits if we reduced our rates somewhat. We therefore cut our day rate to 15 cents per word, no minimum charge, making it now possible to send a message of three words, for instance, at a cost of 45 cents. Our press rate per word is 7½ cents, but for handling the large "press" we now have between the islands we grant special rates to the newspapers, so that they are able to secure as many as 500 words a day per month for a rate of \$75 per month, which brings the cost of "press" to the other islands down to less than one half a cent a word. Our night-letter rate between the islands, for messages filed at any of our stations up to midnight to be delivered the following morning, was 25 words for \$1.50 minimum charge. Under the new rates that has been reduced to 25 words for \$1; 4 cents for each additional word. Our ship-to-shore rate has always been the same, 10 cents per word, \$1 minimum.

¹ To this must be added the ship's charges.

To that rate, of course, must be added the governmental charges if you are speaking a governmental ship, or, if a commercial ship, the commercial charge of that ship.

Now, in case of peril, either real or threatened, our company is perfectly willing to agree (as Mr. Davis, of the United Fruit Co., suggested) that the Government could step in and take over our entire system and personnel without any further authority than what they have now. We are willing at any time to sign an agreement to this effect. And, even going further than that, I noticed in Capt. Bullard's remarks before this committee he stated one of the reasons the naval authorities wished this bill to pass was that to send operators to unknown localities to take charge of unknown stations and unknown apparatus in case of peril or war would cause great confusion. Why, I should think a very simple means of getting around that point would be simply to insert two extra provisions in each operator's license: First, that a radio operator be a citizen of the United States and, second, to make it compulsory in time of peril or in time of war that he should be automatically drawn into the military service of the Army or Navy of the United States. Should you have such provisions in operators' licenses there would be no question as to not having the men who knew the stations and who would probably be more capable than the average Navy operator. Taking up a few other sections of the bill and starting with section 1, it treats the subject of radiotelephony exactly the same as radiotelegraphy, although radiotelephony is just in its infancy, just starting, while radiotelegraphy is over 18 years old. For some time past our company in the islands has seen a growing necessity of having some means of communication between those islands other than radiotelegraphy. There is a demand coming up at the present time to be able to talk from any one telephone on any island to any telephone on one of the other islands. As recently as three months ago I made a tour of the United States with that object in view—that is, to ascertain whether or not the radiophone had been developed to such an extent that it was possible to introduce it commercially between the islands—not to take the place of the radiotelegraph but to be an aid to it, the same as the telephone and the telegraph operate in this country. I might also say that the Mutual Telephone Co. is not only engaged in the telephone business on the island of Oahu but owns as well the entire telephone system on the island of Hawaii. It is necessary, therefore, for us to have some means of communication between our own systems, as well as an aid to the public of Hawaii.

On looking into the matter of radiotelephony I was impressed especially with one thing: That while it might not be a commercial possibility at the present time between our islands, owing to several defects, it is sure to become so within the near future if this legitimate development is not arrested by such legislation as this present bill.

I found the radiotelephone's chief defect for use in Hawaii an inability when operating same to talk and listen at the same time, as when using an ordinary telephone. It acts very much like a speaking tube. You first talk and then listen.

However, even this defect is in a fair way of being overcome, and I have no doubt we could greatly assist in overcoming this in Hawaii

if we were sure the Government would not step in within the immediate future and legislate us out of business, as they now propose to do with our telegraph system. I do not know how much our company would be willing to spend if we could even see a possibility of making a success of the radiophone in Hawaii, but I would place the amount at between \$25,000 and \$75,000 dollars. Such an act as the one now being considered, however, would throttle all effort of advancing the art of radiotelephony in Hawaii.

The CHAIRMAN. In what way?

Mr. BALCH. Why, it is restricted under the same restrictions that apply to the radiotelegraph. Every restriction that applies to the radiotelegraph equally applies to the radiotelephone, and vice versa. Your hours of working are limited to each alternate hour, and how could you use a phone if you had to stop every hour and give the Government a chance? And it is restricted in all sorts of other ways by all sorts of methods—decrements, wave lengths, operators; dozens of different things—all the restrictions that apply to the radiotelegraph.

Section 2 divides our island stations into two types. Our Waihi station is divided as a coastal station (a) and a commercial station (a). All the other interisland stations are classified as commercial stations. Should the Government be allowed to step in and open its station at Pearl Harbor—its ship-to-shore set, for instance—for public correspondence, as under section 5, it would automatically take from us our ship-to-shore business. We could not even sell the station, if we so desired, under this regulation, as we require same to carry on our interisland business.

Section 5 is the section that opens Government stations to ship-to-shore business. The first part of this section opens the licensed stations to public correspondence. As I have stated before, if you open the Pearl Harbor station or any other Government station on Oahu to public correspondence you will automatically take away our ship-to-shore business, that we have built up through years of honest endeavor. We were in that business before the Government had a station in the Territory, and we have built that business up by years of honest endeavor to where we are at a point that our ship-to-shore business is bringing in the sum of approximately \$6,000 net per year. That would be automatically taken over by the Government.

Section 6 gives the naval authorities the right to purchase, at a reasonable valuation, any coastal radio station which the owner may desire to sell. Why, we have not any stations that we desire to sell. We have a system of stations. We have a system that we have built up during the past 16 years. It has taken us these years of honest endeavor to build up this system. If the Government wishes to purchase the wireless department of the Mutual Telephone Co., I have no doubt we are a sufficiently patriotic company to be willing to sell to the Government, although we do not so desire, as we built this system for service and not for sale. All we wish is to be let alone under the present radio act of August 13, 1912. But should the Government desire to purchase our wireless system, it should be condemned as the Government condemns any other piece of property, as, for instance, a piece of real estate, ship, boat, or anything else—

condemned in a proper manner and condemned as an enterprise for profit. It should not be able to have the power, granted by this bill, to set an arbitrary figure, if it so desired, on its junk value or on what was the actual cost of the station. That only means a portion of our system. That does not compensate for the years of honest endeavor that have gone into the making of that system. It is not the stations we have to sell, should the Government desire it, but an organized radio system.

Mr. GOODWIN. Do you desire to sell your system?

Mr. BALCH. No, sir; all we desire is to be let alone. But if the Government really believes that our system is necessary for the preparedness of the country, I feel sure our board of directors, being patriotic American citizens, will sell same if requested, but not at its junk value.

Mr. GOODWIN. Do you think it would impede the development of the system and destroy the radio service? You think it would destroy initiative, do you, of the men engaged in that work?

Mr. BALCH. Absolutely, sir; absolutely. There can be no doubt about it. Look at the history I have given you of our own company and the way the men of Hawaii have striven to perfect radio. It never would have been done there if it had been left to the Government; not at the day and date it was done, at any rate.

Section 11 deals with the licensing of operators, and the portion I object to in this bill is the following:

Whoever shall employ any unlicensed person in the operation of any licensed radio station, or whoever without any operator's license shall operate such a station, shall be punished by fine,

And so forth.

The way we break in most of our operators in the islands so as to make them efficient and a part and parcel of our system is to take a young man, a local boy preferred, and to send him out to a station as a student. As such we start him in at \$35 to \$40 per month. We give him a careful training first in the gas engine. The gas engine is the all-important part of our system. We have our stations located in out-of-the-way places in many instances, and without gas engines we could not operate.

The student is therefore given a thorough training in the care of engines and accumulators. He is, then, in his spare moments, instructed in the use of the code. He sits beside the operator during the business hours, or while the system is open, and gradually he is taught to receive by listening in with a pair of duplicate phones. Then, after a period of, say, five or six months, he is usually able to take traffic during the nonrush hours of the day. This work usually is done while the operator himself is sitting alongside of the student, but sometimes not. Sometimes the operator will take advantage of the student being in a fairly well-qualified state to go off about his business, to take care of his gas engine and accumulators, or to go to the post office, or something else. This clause would absolutely prevent our breaking in students in this manner. And students that are taught by this system are real wireless men when they go to be examined for their license.

Mr. BRUCKNER. How long does it take to develop them?

Mr. BALCH. About 8 months; in some cases longer. I have seen one instance when it took 14 months.

Section 17, regarding the logarithmic decrement. As I stated before, in 1912 we practically junked our entire system in order to comply with the new act of August 13, 1912, and put in new equipment, which we purchased from the Marconi Co., so as to bring our logarithmic decrement under 0.2 and comply with the numerous other qualifications demanded by the Government. Should the Government at this stage now demand a finer decrement it would again necessitate the junking of our system in order to get it. I believe, myself, that the decrement of 0.2, which is now authorized by the law, is fine enough, and that if operators are not capable of working through interference caused by a 0.2 decrement wave they won't be able to work through it anyway.

Section 20, that commercial stations shall not use a transmitting wave length of 1,800 meters, etc. Our stations are licensed for point-to-point service between the islands on 575 meters. Now, 575 meters, as I mentioned before, is bound to interfere with the Government short-wave station working to ships, for instance, on 600 meters, should they both desire to work at the same time. You can not help it. They are sure to interfere. The stations are only 10 miles apart, and they are bound to interfere. And should such a thing occur the Government could immediately force us, as the first step, to go to 1,600 meters. Now, would that help matters? Could we with spark sets, for instance, operate two stations 10 miles apart by the mutual station going on 1,600 meters? I do not believe it. Such a thing may be possible, but I do not believe it is at the present time. It may come in time with the development of the art. That would necessitate, in turn, our going above 4,000. To go above 4,000 every bit of apparatus we have at the present time, gentlemen, would have to be thrown into the scrap heap just because we had to comply with some regulation that is not needed in Hawaii, and this could be done at the beck and call of any radio inspector who was sent there by the Department of Commerce.

There is no question but what our present apparatus is efficient. We sent 28,000 paid messages last year between the islands and the ships at sea.

I do not believe there is anything further that I can add to what I have already said. I believe that our company, an American company—all the stockholders are Americans—is just as patriotic as anybody. During the present war, and under naval censorship, the Government, instead of sending a censor to each one of our stations, has confined itself to censoring our messages in Honolulu every three or four days. Even at the time the German ships, the Japanese ships, and the British ships were all hovering around Hawaii, the censorship of our entire system was left in my hands; in other words, I, as an American citizen, had to obey the President's order. And it was obeyed. There has not been one case during the present war where our operators have violated the neutrality as laid down in the President's instructions. We are American citizens, and would not willfully break the neutrality of the Government in any way, shape, or form. Once, being nervous that some of our operators would err in doing something that would be considered unneutral, I asked the authori-

ties at Pearl Harbor to send a censor to each of our island stations. They merely stated they had no officers to send out, and that they held the company absolutely responsible for the neutrality of the system and its employees. That shows that the system of censoring messages at the present time is absolutely left to the honesty of the company which is operating, and in our case we have absolutely lived up to it with an honest and with a conscientious endeavor to protect the neutrality of our country.

Mr. EDMONDS. Mr. Balch, are your operators now American citizens?

Mr. BALCH. Yes, sir; every operator we have is an American citizen, and most of them have been in the employ of the company for many years. We have four, all told, who have been with the company since its commencement 16 years ago.

The CHAIRMAN. How many operators have you in your employ?

Mr. BALCH. We have about 14 or 15.

Mr. EDMONDS. How many students?

Mr. BALCH. There are two at present.

FURTHER STATEMENT OF COMMANDER DAVID W. TODD, UNITED STATES NAVY.

Commander TODD. May I make a few remarks in regard to what Mr. Balch has said.

The CHAIRMAN. Yes.

Commander TODD. I am able to corroborate most of what Mr. Balch has said. The Mutual Telephone Co. does deserve very great credit for the way they have built up their system, and I would say that if any of their stations should be bought, the whole system of the company should be bought.

The business of the company is not so very great. Taking the figures he has given of the number of interisland messages, and taking 300 working days and estimating no messages at all are sent on Sundays or holidays, the average is about 52 messages a day between all five islands covered by the system. If they worked only eight hours, that means six and a half messages an hour. That does not seem to be so many for five stations, and the business is not very great. The ship business amounts to much less; it amounts to about 18 to 21 messages a day, and the South Sea business amounts to about one message a day for the first year and two for the second. That shows that, while the interests of the company are very great to their clients and to themselves, it would not be a very great burden for the Government to take over.

On the question of interference, Mr. Balch is quite right in saying when the Pearl Harbor station is working on the longer wave lengths, above 5,000, it will not interfere with his work in any way whatever; and he is also quite right in saying that if we do work with ships, we shall have to follow the London convention the same as he does and everybody else; and, as a result, we shall interfere with his short wave length transmission and he will have to spend some money to get away from that. That is, the interisland work will have to be done on the longer waves permitted by the present act. We expect no interference at Pearl Harbor from this station except on those

short wave lengths. He will not interfere with us on the long wave lengths any more than we will with him, but the Marconi Co. will do that very successfully. This will be for many technical reasons; not only the reasons Mr. Balch gave you of the trouble they have had from the spray and the poor insulation, but because of the type of transmitter in the Marconi station, which is positively out of date for a high-power station. All the technical men in the world know it, or should know it.

I am very glad that Mr. Balch shows conclusively he is not allied with the Marconi Co., but simply working under their patents. Mr. Balch's apparatus is not the latest. It is very good, and complies with the present law in every way.

The question of licensing operators does not interfere with radiotelephony. Mr. Balch should not assume that Government control or operation of those stations would eliminate the radiotelephony entirely. The Government operation of those stations would include radiotelephony when sufficiently developed, if there were any field for it or any demand for it. From the evidence that has been brought before this committee, the Government installations are not only up-to-date, but are always a little in advance, and often a great deal in advance of commercial working, and it would not be right to claim that the Government would not use radiotelephony between those islands if it could be done, or when it can be done.

The question of licensing operators for using radiotelephones is one that is easily covered. The radiotelephone can interfere with radiotelegraphy, and the only reason for these regulations, as far as they fall short of Government ownership for military and political reasons, is for the prevention of interference. If the radiotelephone can interfere, then it must be in charge of some person who knows when he is interfering, knows how to operate it and get it in shape for the subscriber to use, before it is used, so as not to interfere with existing communications.

I invite your attention to his statement that agents of the Japanese Government have had a chance to examine the stations of the Mutual Telephone Co. Maybe they were after technical details, but I think it is a bad scheme to permit it in Hawaii.

If all the business of the Navy could be handled without interfering with Mr. Balch's system, I should be glad. There is a system that has been built up through all these years, is working, is part of their telephone business, and if they could work without interference, or without being covered by this broad principle of Government ownership, it would be well to recognize that system and let it go on; but Government ownership is sure to come. I have had long conversations with Mr. Balch, and he knows my point of view and I know his; and I can see how the idea of Government ownership, as so strongly brought forth, with all the cards on the table, is acting as a check to his company in developing the system any further. "What is the use of developing the system any further if the Government, sooner or later, is going to buy us out?"

The CHAIRMAN. The point he makes is that if the Government should buy them out, it should not simply take over one station, but take over the whole system and pay them—either condemn it, or by an agreement pay them what it is reasonably worth.

Commander TODD. I entirely agree with him there, but I object to the word "junk,"—that we would buy the system at its "junk" value. Mr. Balch has assumed that some autocratic action on the part of Congress will make him sell out his stations at junk value.

Mr. GREENE. Oh, no; not on the part of Congress—autocratic action of the Navy Department, not of Congress. Don't put it onto us.

Commander TODD. I withdraw that remark, sir.

The CHAIRMAN. We are primarily responsible.

Mr. EDMONDS. Oh, no; we give them the money; that is all.

Mr. GREENE. We give them the money, but we do not allow them to go around and cut people's throats, if we can help it.

Mr. EDMONDS. We do not do any autocratic acts, if we can help it.

Commander TODD. Congress provides the money to buy out this system, I will say. Mr. Balch is wrong in assuming that his system would be bought out at junk value. The question of how the systems shall be bought, or who shall determine what their value is, is not provided for in this bill. Nor do I know of anybody who has thought out any definite plans for accomplishing this proposed purchase. It would have to be provided for by Congress, possibly. Personally, that is the last thing with which I would want to have anything to do. I should have my troubles, standing by to operate this system.

Mr. RODENBERG. Who was responsible for inserting this word "junk" in the hearing?

Mr. EDMONDS. I think it has been the idea all through the testimony that the plants would eventually become junk if the Government took away from them all of this work; and therefore the value of the stations would be so reduced that they would have to sell at junk prices.

Mr. HADLEY. On the point of the interdepartmental committee not having considered the means of taking over these stations and arriving at a value (of course that is a matter which is involved and ought to be considered along with the bill), why did not so important a matter as that receive consideration?

Commander TODD. It took a whole year to get this bill into the shape it is in now, and that meant study and hard work, as often as the members could be gotten together, or even a few of them. We had no time to go into such details, although they were probably discussed without any definite idea of how the matter should be handled being brought before the committee.

The CHAIRMAN. I believe the bill says that they should be paid a reasonable value. Is that the language?

Commander TODD. "At a reasonable valuation," yes, sir.

The CHAIRMAN. But you do not say how that should be ascertained. I assume that the committee would determine on that policy, just like they did in the shipping bill—they would provide a way by which it might be done equitably, either by condemnation, in the absence of an agreement between the parties, or by an impartial appraisal. That would be the only equitable way to arrive at it.

Commander TODD. The committee assumed that a proper way of doing that would ensue. They were interested in getting the principle in the bill and leaving the details for future consideration.

Mr. EDMONDS. You said a minute ago, Commander, that Government ownership was inevitable. You did not mean that?

Commander TODD. I did not mean that it is inevitable, sir; I meant to say that it was in my opinion.

Mr. EDMONDS. Oh, in your opinion?

Commander TODD. Yes, sir.

Mr. EDMONDS. That was because you did not want this man to go away discouraged with the idea that Government ownership was coming in four or five years.

Commander TODD. I was not quoting the conversation with Mr. Balch. I did state that I considered Government ownership to be a necessity, and sure to come.

Mr. EDMONDS. No; but you said it was inevitable.

The CHAIRMAN. I assume that is just his opinion.

Commander TODD. That is my recollection of the conversation—that I said that it was inevitable; that I saw it coming.

Mr. EDMONDS. I thought possibly you had some reason back in your mind, or they might feel back in their minds, it was absolutely inevitable that the Government would have to take over these plants.

Commander TODD. No, sir; we are entirely in your hands in that matter.

Mr. SAUNDERS. Was it the idea of the committee in dealing with this matter that Government ownership ought to be inevitable, or were they just treating it as something that was coming—as something which in their judgment was inevitable—and therefore the legislation, so far as we were enacting it in the present bill, should be enacted with reference to something that was sure to come.

Commander TODD. No, sir. The committee was divided on the subject of Government ownership. Some were for the whole thing and some were for buying the coastal stations only, just so far as this bill goes. They did not say it was inevitable, but it was the sense of the committee and as expressed in the bill that it was very desirable. They did not go so far as compulsory and complete Government ownership, but a number of members expressed themselves as being personally in favor of it.

Mr. GREENE. Might I suggest as you have taken a year to get what you have in here that you certainly could not expect this committee, in a few days or a few hours or a few months, with all the other work they have to do, to be able to work that matter out. You have expended your energies in getting this much. All the departments together, with all the wisdom you could rake and scrape, have gotten something together which you have sent here, and you could not expect us now to determine a plan by which we could equitably deal with all these vast propositions and let the Navy be running that with everything they have—you could not expect that?

Commander TODD. We could not expect it; we could only hope.

Mr. GREENE. You could not have much hope. You will have to go a long time before you get that, and you will get a chance to rest quite a while.

The CHAIRMAN. On that question I want to say for the benefit of Mr. Balch—and I think I reflect the sentiments of the committee—that even if the sentiment of Congress should finally crystallize in

favor of Government ownership and control of wireless in the interest of national defense, yet I assume that in no event would they take over these private properties without paying their value—not their junk value, but their full value.

Mr. RODENBERG. The reason I asked that question a while ago, I wanted to know if the bill referred to it as so much junk.

Mr. BURKE. The opponents of the bill have been using the words "junk" and "scrap" indiscriminately.

Mr. CHAIRMAN. They have bandied that word back and forth without any justification whatever. If you go on and develop, and the Government ever does take over your plant, the chances are it will pay every nickel it is worth, and then some.

Mr. BALCH. Speaking of the word "junk," Commander Todd just stated it was not necessarily the junk value of our plants. Just before that he mentioned that the Marconi station that had been erected on Oahu, at an expense of almost a million dollars, was out of date; it was out-of-date equipment. It was out of date, he stated, before it was built. Why, how could it be out of date? They are working; it is accomplishing communication between San Francisco and Japan at the present time. As for the matter of interference, he says it interferes. But as for that, we are working our station successfully within 15 miles of that station. While I am not here to defend the Marconi Co., I look upon them with a great "aloha." Mr. Marconi I know personally, and they were the first to come into the islands, as far back as 1899, and start the system.

Mr. RODENBERG. It is the brains of Marconi which were responsible for the art, and not the brains of the Navy Department.

Mr. BALCH. If you refer to the system as "out of date," you refer to it as junk.

Mr. EDMONDS. That is a common commercial term that is used with respect to machinery that is out of date.

Mr. BALCH. Well, it is junk, then.

Commander TODD. Mr. Chairman, I can not recall any statements made by the proponents of the bill that refer to any apparatus as junk. I am almost sure (it would take a careful examination of the testimony to show it) that that word was introduced by those who are opposed to this bill. The transmitters of the high-power Marconi stations are out of date, not the other machinery, buildings, masts, receiving arrangements, etc.

The CHAIRMAN. I think Mr. Edmonds has interpreted all that has been said correctly, that if the Government should increase its service in the vicinity of privately owned stations and reduce rates it would destroy the value of their properties; and, of course, they would have no commercial value then and would be taken over as what you call junk.

Mr. ROWE. It depends altogether, Mr. Chairman, on when you take over a property. If you should start competitive stations in the Hawaiian Islands to do a commercial business, of course in a year or two their business would not be worth anything. And then if you wanted to take over their plants you would not have to pay anything even if you paid their real value.

The CHAIRMAN. I say that is the way the word "junk" was used.

Mr. SAUNDERS. If we take steps that make the property of private concerns valueless, it is junk.

The CHAIRMAN. That is what I say.

I have some letters which I believe Commander Todd wants to have go into the record. There is one from the Department of Agriculture. You will remember that department had representatives on this departmental committee. There is one here from the Alaska Wireless Telegraph Co., and also letters from the Panama Railroad Co., the North Pacific Steamship Co., the Pacific Radio News, the Philadelphia Maritime Exchange, the Gulf Refining Co., and the Goodrich Transit Co.

I will also insert in the record "Important Events in Radiotelegraphy" by the Bureau of Navigation, Department of Commerce; also a list of the radio stations of the United States, taken from the Radio Service Bulletin of the Bureau of Navigation, Department of Commerce, for November, 1916.

DEPARTMENT OF AGRICULTURE,
Washington, January 24, 1917.

HON. J. W. ALEXANDER,

*Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives.*

DEAR MR. ALEXANDER: I have your letter of December 23 requesting an expression of opinion regarding bill (H. R. 19350) to regulate radio communication and have given the matter careful consideration.

This bill is designed to provide a better system of control and regulation of radio communication approaching Government ownership. It aims to make the conduct of radio communication more effective and efficient, especially along coastal regions. This is accomplished, first, by restricting the establishment of unnecessary stations and eliminating conditions leading to avoidable interference; and, second, by opening all Government stations to commercial business. This provision has my hearty approval. Obviously, the Government must maintain coastal stations of the most efficient character; in fact, the military branches of the Government, chiefly the United States Navy, now maintain a number of large and important well-equipped stations. Daily use of the system and the constant and continual practice of the operators are prerequisites to efficiency. To deny or fail to afford full opportunity for practice and training tends to impair the efficiency of this valuable agency of the Government to weaken its preparedness to meet sudden emergencies. The opening of Government stations to commercial work is administratively necessary in the interests of efficiency and economy.

When Government stations engage in commercial business unprofitable competition will at once arise in a number of cases. Section 6 of the bill authorizes the Government to purchase, within a prescribed time, those stations whose private owners desire to sell at a fair valuation and who will be placed at a commercial disadvantage in trying to conduct business in competition with the Government. While I think this is a step in the right direction and approve this provision, a careful consideration of the matter convinces me that it would be preferable to make mandatory the purchase, within a reasonable time and at a fair valuation, of all commercial stations engaged in ship-to-shore communication. It necessarily follows that no new stations for such work should be licensed.

I think it is essential that all high-power stations for long-distance communication should be under strong and instant Government control; that they should be owned and operated only by Americans; and that the transfer of ownership or control to aliens should be prohibited. The provisions of sections 7, 8, and 9, as far as they go, seem adequate for this purpose. Complete Government control of wireless communication, however, must be regarded as inevitable in the relatively near future and is made necessary by considerations of national welfare and security.

The statement that Government ownership will stifle the art or its development should not be taken seriously. There is every reason to believe that wireless communication under Government control would result in public benefits of many kinds, especially to marine commerce and navigation. The Weather Bureau of this department now profits by cooperation with the Navy Department in the collection of marine reports and in the dissemination of storm

and hurricane warnings to ships at sea and throughout certain remote regions, such as Alaska. No other means of communication can be employed in many instances, and the highest efficiency in the maintenance of wireless communication is practically unattainable in the present state of the art without Government control.

Provision is made in the bill for every reasonable interest and proper activity on the part of amateurs. It might be desirable, however, to require amateurs to register their stations with some district Government station in the vicinity and to enlist as volunteers for certain services provided for by suitable regulations.

My views regarding the bill may be summarized as follows:

(1) I heartily approve the bill in its present form as the minimum regulation and control of radiocommunication.

(2) I recommend that the bill be strengthened by providing for the ultimate complete Government control of all wireless communication. This result may be attained partially and by steps as follows:

(a) By providing for the compulsory sale and purchase, within a reasonable time and at a fair compensation, of existing coastal stations for ship-to-shore communication, and by prohibiting the establishment of new stations of this kind.

(b) By prohibiting the establishment of new stations of any kind, if Government ownership of all stations is contemplated but not provided for in the new legislation.

Very truly, yours,

D. F. HOUSTON, *Secretary.*

60 BROADWAY, N. Y.,
January 23, 1917.

Mr. J. W. ALEXANDER,
Chairman Committee on Merchant Marine and Fisheries,
Washington, D. C.

DEAR SIR: I thank you for your letter of January 8, inclosing copy of H. R. 19350. This company owns two wireless-telegraph stations in Alaska which are in operation and has the instruments for a third station which, however, has not yet been erected. We work with the wireless stations under the control of the United States Signal Corps, but have no desire to extend the business; in fact the enterprise has not been profitable, and we would be willing to sell the plants to the Government, if it wishes to take them, at considerably less than they cost.

Yours, very truly,

ALASKA WIRELESS TELEGRAPH CO.,
FALCON JOSLIN.
Iditarod, Alaska.

PANAMA RAILROAD CO.,
New York, January 18, 1917.

Hon J. W. ALEXANDER,
Chairman Committee on the Merchant Marine and Fisheries,
Washington, D. C.

DEAR SIR: We acknowledge receipt of your letter of the 8th instant inclosing bill, H. R. 19350, to regulate radio communication. We have carefully read all the clauses contained in this bill and find nothing therein to which we can offer objection.

Yours, respectfully,

T. H. ROSSBOTTOM,
Assistant to Vice President.

NORTH PACIFIC STEAMSHIP CO.,
San Francisco, Cal., January 15, 1917.

Hon J. W. ALEXANDER,
Chairman Committee on the Merchant Marine and Fisheries,
Washington, D. C.

DEAR SIR: We desire to thank you for your communication of the 8th instant, together with copy of H. R. 19350. However, while we are very glad indeed to receive this letter, the time which we have at our disposal for its study

and consideration is very short, inasmuch as this document did not reach us until January 12, and the hearing, according to your letter, took place on January 11; therefore we start out with a handicap of exactly 24 hours to begin with.

However, in view of the fact that I believe everyone interested in the shipping business concedes that radio service on the ocean should be under Government control, and as this bill is one which is intended to bring about that result, there is probably adverse comment in reference to the matter.

Therefore, hoping that the bill has been drawn in such shape that it will be a workable and equitable measure, also thanking you for having forwarded the text of the bill to us, I remain,

Yours, truly,

CHAS. P. DOE, *President.*

PACIFIC RADIO NEWS,
San Francisco, January 17, 1917.

HON. J. W. ALEXANDER,
Chairman Committee on the Merchant Marine and Fisheries,
Washington, D. C.

DEAR SIR: I have for acknowledgment your request of January 8, relative to the furnishing of an argument pro or con in regard to the reading of the new proposed bill H. R. 19350.

As this bill has already passed its hearing we doubt if any further comment will be necessary. We wish to state, however, that the publishers are heartily in favor of seeing the bill become a law.

The alien clause, as well as the one relative to the control of capital stock, are clauses that should be passed without delay.

Our magazine columns are open to news matter regarding the proceedings of the committee, and we trust that you will advise us of the important steps taken by the committee in regard to the framing of the bill.

Thanking you in advance for this favor, we are,

Yours, very truly,

PACIFIC RADIO PUBLISHING CO.,
H. W. DICKOW, *Editor.*

THE PHILADELPHIA MARITIME EXCHANGE,
Philadelphia, January 27, 1917.

HON. J. W. ALEXANDER,
Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives, Washington, D. C.

DEAR SIR: The Philadelphia Maritime Exchange desires to record its approval of the bill H. R. 19350, which has for its object the regulation of radio communication, believing the provisions of said bill to be directly in the interest of maritime commerce, and respectfully urges its favorable consideration and report by your honorable committee.

Yours, faithfully,

E. R. SHARWOOD, *Secretary.*

GULF REFINING CO.,
New York, January 27, 1917.

HON. J. W. ALEXANDER,
Chairman Committee on the Merchant Marine and Fisheries,
House of Representatives, Washington.

DEAR SIR: Replying to your desire to have an expression of opinion from us upon H. R. 19350, about radio communication, your letter being addressed to Port Arthur, Tex.:

Our understanding is that the aim of this bill is to have all land stations taken over by the Government, or placed under Government control, and from the experience we have had we do not feel that this will be beneficial.

The use of wireless from and to our ships is mostly of a commercial character, particularly when coming into or going out of port, requiring constant and uninterrupted service, and we feel that any departure from this which would likely result from departmental or governmental control would adversely affect the satisfactory service we are now receiving.

Yours, very truly,

JAMES KENNEDY.

GOODRICH TRANSIT Co.,
Chicago, January 27, 1917.

Hon. J. W. ALEXANDER,
Chairman Merchant Marine and Fisheries Committee,
Washington, D. C.

SIR: Relative to the wireless question, on which the Committee on Merchant Marine and Fisheries are holding hearings:

This company has always advocated Coast Guard stations being equipped with wireless by the United States Government. Within the last 60 days we have had two steamers in trouble through stranding and, due to the severity of the winter, many delays on account of ice conditions. The following are concrete examples of conditions that prevail:

On December 4, 1916, our steamship *Carolina* went ashore on the rocks 7 miles north of Algoma, Wis. While it is true that the steamer's wireless was useless after a very short time, still the wrecker *Favorite* was outside the reef for several days. The *Favorite* is equipped with wireless. At certain times of the day and night it was impossible to get into communication with the wireless stations. As far as I know, there is not one single wireless station on Lake Michigan that gives 24 hours' service. There are seven or eight lines of steamboats operating on Lake Michigan throughout the entire winter. Some of the Coast Guard stations are open the year round; men on lookout all the time. You can understand what a measure of safety it would be if these stations were equipped with wireless, and what a relief it would be to the masters sailing these ships throughout the entire winter.

On Sunday morning, January 14, 1917, our steamship *Indiana* went on the submerged portion of the extension of the Government breakwater, Chicago Harbor. Was on until Tuesday afternoon. Steamer had full use of wireless the entire time she was on, and we communicated with her many times each 24 hours, but there were certain hours that the Chicago wireless station was closed, during change of watch or at meal hours, when we could not communicate with the steamer or the steamer with the shore.

On Friday, January 19, 1917, our steamship *Alabama* was stuck in the ice three-quarters of a mile off Grand Haven. Was in a more or less dangerous position. Steamer was considerably listed. We were very anxious to get in touch with her. Chicago shore station was closed from 11.30 to 12.30 noon. Master of *Alabama* attempted to send wireless to Grand Haven to send tugs or car ferries to his assistance. Grand Haven wireless station not open during the daytime; necessitated master of *Alabama* sending wireless message to this office, which was delayed on account operator being away at noontime. After this office having received message it became necessary to use the long-distance telephone to Grand Haven to get word to our office notifying them of the steamer needing assistance.

It is to protect the lives and property that we believe the Government should equip the Coast Guard stations with wireless.

Respectfully,

H. W. THORP, Vice President.

[Department of Commerce, Bureau of Navigation, Radio Service.]

IMPORTANT EVENTS IN RADIOTELEGRAPHY.

IMPORTANT EVENTS IN RADIOTELEGRAPHY—PEAKS IN THE WAVES OF WIRELESS PROGRESS.

1831.

Faraday discovered electromagnetic induction between two entirely separate circuits.

1833.

Steinhell discovered the use of the earth return.

1840.

Henry first produced high-frequency electric oscillations and pointed out that the discharge of a condenser is oscillatory.

1842.

Morse made wireless experiments by electric conduction through water.

1843.

Lindsay suggested that if it were possible to provide stations not more than 20 miles apart all the way across the Atlantic there would be no need of laying any cable.

1845.

Lindsay made experiments in transmitting messages across the River Tay by means of electricity or magnetism without submerging wires, using the water as a conductor.

1849.

Wilkins revived the same suggestions for wireless telegraphy.

Dr. O'Shaughnessy succeeded in passing intelligible signals without metallic conduction across a river 4,200 feet wide.

1862.

Heyworth patented a method of conveying electric signals without the intervention of any continuous artificial conductor.

1879.

Hughes discovered the phenomena on which depend the action of coherer. The coherer was later used practically by Marconi.

1880.

Trowbridge found that signaling might be carried on over considerable distances by electric conduction through the earth or water between places not metallically connected.

1882.

Bell, experimenting with Trowbridge method on the Potomac River, resulted in the detection of signals at a distance of $1\frac{1}{2}$ miles.

Prof. Dolbear was awarded a United States patent in March, 1882, for wireless apparatus in connection with which he made the statement that "electrical communication, using this apparatus, might be established between points certainly more than one-half mile apart, but how much farther I can not say." It appeared that Prof. Dolbear made an approach to the method that was subsequently, in the hands of Marconi, to be crowned with success.

1883.

Fitzgerald suggested a method of producing electromagnetic waves in space by the discharge of a conductor.

1885.

Edison, assisted by Gilliland, Phelps, and Smith, worked out a system of communication between railway stations and moving trains by means of induction and without the use of conducting wires.

1887.

Hertz showed that electromagnetic waves are in complete accordance with the waves of light and heat and founded the theory upon which all modern radio signaling devices are based.

1892.

Branly devised an appliance for detecting electromagnetic waves, which was known as a coherer.

1894.

Rathenau experimented with a conductive system of wireless telegraphy and signalled through 3 miles of water.

1895.

Marconi's investigations led him to the conclusion that Hertzian waves could be used for telegraphing without wires.

1896.

Marconi lodged his application for the first British patent for wireless telegraphy.

1897.

November 1.—First Marconi station erected at the Needles, Alum Bay, Isle of Wight. Experiments were conducted covering a range of 14½ miles.

1898.

July 20 and 22.—Events of the Kingstown regatta in Dublin reported by wireless for Dublin newspaper from steamer *Flying Huntress*.

1899.

September and October.—Races between *Shamrock* and *Columbia* reported by wireless for New York Herald.

1900.

March.—Radio apparatus installed on R. M. S. *Kaiser Wilhelm der Grosse*.

1900–1905.

Between these years Dr. De Forest was granted numerous patents in the United States and other countries for inventions connected with wireless telegraphy.

1901.

December 12.—The letter "S" was received by Mr. Marconi from Poldhu, England, at St. John's, New Foundland.

Prof. R. A. Fessenden applied for United States patent on September 28 for "Improvements in apparatus for the wireless transmission of electromagnetic wave, said improvements relating more especially to the transmission and reproduction of words or other audible signals." It appears that in connection with this apparatus there was contemplated the use of an alternating current generator having a frequency of 50,000 per second.

Prof. Fessenden was granted a number of United States patents between 1899 and 1905 covering devices used in connection with radiotelegraphy.

1901–1904.

It appears that during this period Dr. John Stone was granted more than 70 United States patents covering radiotelegraphy.

1901–1905.

More than 40 United States patents were granted to Harry Shoemaker covering certain apparatus used for radio communication.

1902.

February.—Steamship *Philadelphia*, American Line, received messages a distance of 1,551½ statute miles and received Morse signals up to a distance 2,099 statute miles from Poldhu station, Cornwall.

1903.

January 19.—President Roosevelt sent a trans-Atlantic radiogram to King Edward via Cape Cod and Poldhu stations.

March 30.—First transoceanic Marconigram was published in the Times.

August 4.—First International Radiotelegraphic Conference was held at Berlin.

1904.

A wireless-telegraph act was passed by the British Government.

1905.

In October of this year erection of Clifden, Ireland, high-power radio station was commenced.

1906.

Dr. De Forest was granted a patent on January 18 for a vacuum rectifier, commercially known as the audion.

Second International Radiotelegraphic Conference was held at Berlin, and a convention was signed by a majority of the principal countries of the world.

1907.

October 17.—Marconi transatlantic stations at Clifden and Glace Bay were opened for limited public service.

1908.

February 3.—Transatlantic radio stations were opened to the general public for the transmission of messages between the United Kingdom and the principal towns in Canada.

In carrying out his invention Prof. Fessenden constructed a high-frequency alternator with an output of 2.5 kilowatts at 225 volts and with a frequency of 70,000 cycles per second. Later on Prof. Fessenden reported successful wireless telephonic communication between his station located at Brant Rock, Mass., and Washington, D. C., a distance of about 600 miles.

1910.

Messages received on the steamship *Principessa Mafalda* from Clifden, a distance of 4,000 miles by day and 6,735 miles by night.

June 24.—Act approved by the United States Government requiring radio equipment and operators on certain passenger-carrying vessels.

1911.

July 1.—Radio Service organized by Department of Commerce and Labor to enforce act of June 24, 1910.

1912.

June 4.—Third Radiotelegraphic Conference opened at London, and approved important regulations to secure uniformity of practice in radiotelegraphic services.

July 23.—Act approved by the United States Government extending act of June 24, 1910, to cover cargo vessels, and requiring auxiliary source of power, efficient communication between the radio room and the bridge, and two or more skilled radio operators in charge of the apparatus on certain passenger-carrying vessels.

August 13.—Act approved by the United States Government to regulate radio communication. Under this act radio operators and transmitting stations are licensed.

1913.

November 12.—Safety at Sea Conference held in London. At this conference the use of radio received appropriate consideration.

November 24.—The first practical trials with wireless apparatus on trains were made, messages having been received and transmitted on board trains.

The wireless station at Macquerie Island was the means of keeping Dr. Mauson, the Australian explorer, in touch with the outer world. A small journal, the *Adelle Blizzard*, was established, the news being received by radio.

1914.

A new departure in the application of radiotelegraphy to the safety of life at sea was the equipment of the motor lifeboats of the steamship *Aquitania* with radio apparatus.

High-powered transoceanic stations were completed at Carnarvon, Wales, Belmar, Honolulu, and San Francisco during the autumn of 1914. The Honolulu-San Francisco stations were opened to public service September 24, 1914. The Tuckerton-Elilvese and Sayville-Nauen stations were in operation about this time.

Most of these stations made use of the latest developments in the art, using undamped and long waves as produced by the Poulsen arc and the radio-frequency alternator.

1915.

Great progress was made in the field of radiotelephony. In this country the voice of a person speaking into the radiotelephone at Arlington, Va., was heard at Honolulu, Hawaii, and at Paris, France. In Germany a system operating practically over several hundred miles was developed.

Ship service was greatly improved through the installation of new equipments, embodying features of great practical value, by various operating companies. Efficient emergency radio transmitters came into wider use, owing considerably to the efforts of the Radio Service of the Department of Commerce and its refusal to pass inefficient equipment. Such installations considered as essential are safeguards to shippers and the seagoing public.

SOME RECENT DEVELOPMENTS.

The passage of the act of August 13, 1912, to regulate radio communication, made necessary the development of special types of radio-measuring apparatus for the use of the radio inspectors. One of the most important of these measuring instruments was invented and developed by F. A. Kolster, of the Bureau of Standards, and is used to make direct measurements of wave length and logarithmic decrement. The instrument is unique in its design and was exhibited and demonstrated at the joint safety-first exhibit of the Bureau of Standards and Bureau of Navigation held in Washington from February 21 to February 26, 1916, in the National Museum.

Several years ago Mr. Kolster realized the importance of radio signaling in its relation to safety of life at sea and to aids to navigation.

In the early part of 1913 Mr. Kolster submitted to an interdepartmental committee a memorandum pointing out the advantages of certain applications of radio signaling for use at lighthouses, lightships, and life-saving stations, especially in time of fog.

From then until the present time experiments have been conducted at the Bureau of Standards leading toward the development of suitable apparatus for this purpose.

The results of this work were shown at the safety-first exhibit mentioned above. Actual working models of the experimental apparatus were demonstrated. The apparatus is extremely simple, compact, easily installed and operated, and inexpensive. Recent experiments have developed a much wider field of application than at first contemplated.

An outline of a few possible applications is as follows:

1. Installation at lighthouses, lightships, life-saving stations, and other important points will have a twofold value so far as safety at sea is concerned, especially in time of fog.

2. Set signals sent out by the automatic transmitters will enable vessels equipped with the special receiving devices accurately to determine their positions and ranges by triangulations.

3. Vessels equipped with ordinary radio transmitters may send out signals which when received by the lighthouses, or other especially equipped receiving stations, will enable the operator to advise the ship of its position.

4. Collisions of ships at sea in fog may be readily avoided by the use of this apparatus which will determine direction and distance.

The Radio Inspection Service of the Department of Commerce contemplates the use of this device in all of its offices to locate amateur or other stations that are not observing the radio laws and regulations.

A comparatively small model is now installed in a room of the Bureau of Standards, with which messages are received from practically all high-powered stations in the United States and from Germany.

RADIO INSPECTION SERVICE.

The first act requiring radio apparatus on certain passenger-carrying vessels was approved June 24, 1910. Under this act the Secretary of Commerce and Labor organized on July 1, 1911, the Radio Service, composed of three inspectors with headquarters at New York, N. Y., Baltimore, Md., and San Francisco, Cal.

The second act, approved July 23, 1912, amended the above act so as to cover all vessels navigating the ocean or the Great Lakes and licensed to carry or carrying 50 or more persons, including passengers or crew or both, with the exception of steamers plying between ports or places less than 200 miles apart. This act also requires an auxiliary source of power independent of the vessel's main electric power plant, which will enable the sending set for at least four hours to send messages over a distance of at least 100 miles; efficient communication between the operator in the radio room and the bridge; and that the radio equipment must be in charge of two or more persons skilled in the use of such apparatus, one or the other of whom shall be on duty at all times while the vessel is being navigated, with the exception of cargo vessels, on which, in lieu of the second operator, a member of the crew competent to receive and understand distress calls and other calls indicating danger may be substituted to aid in maintaining a constant wireless watch, so far as required for the safety of lives.

The act to regulate radio communication was approved August 13, 1912. Under this act transmitting stations and radio operators are licensed by the Secretary of Commerce. Transmitting stations are inspected to determine if they comply with the requirements of the law. Radio operators are examined in order to determine their qualifications.

In addition to the above-mentioned acts the department also enforces the London International Radiotelegraphic Convention rules of 1912, to which the United States is a party.

Land radio stations are classified as follows: Public service, general; public service, limited; limited commercial; experimental; technical and training school; special amateur; general amateur; and restricted amateur.

Radio operators are classified as follows: Commercial extra, first grade; commercial, first grade; commercial, second grade; commercial, cargo grade; experimental and instruction grade; amateur, first grade; and amateur, second grade.

The use of radio apparatus on vessels carrying passengers or 50 or more in crew is now accepted as essential to the safety of those on board, which fact is clearly illustrated by the number of vessels voluntarily equipped with radio apparatus, and in order to enforce the laws the following force is engaged in this work:

In addition to the office force in the Bureau of Navigation the field force now embraces one radio engineer, 12 inspectors, and 8 clerks, having headquarters as follows: Boston, Mass.; New York, N. Y.; Baltimore, Md.; Savannah, Ga.; New Orleans, La.; San Francisco, Cal.; Seattle, Wash.; Detroit, Mich.; and Chicago, Ill.

WIRELESS AS A SAFEGUARD TO LIFE AT SEA.

The bureau has a record of the following vessels equipped with radio apparatus, to which accidents have occurred during the past 15 years, wherein wireless played an important rôle in the saving of human life.

1899.

March 3.—Steamship *Matthews* ran into the East Goodwin Lightship. The accident was reported by wireless, and lifeboats were sent to the relief of the lightship.

1901.

January 1.—Steamship *Princesse Clementine* reported the bark *Medora* waterlogged, resulting in a tug being sent to her assistance.

1903.

December 18.—Steamship *Kroonland*, Red Star line, disabled; passengers saved great inconvenience by radio communication being established with Crookhaven.

1904.

During this year accidents to the steamship *New York* and the steamship *Friesland* were reported by radio.

1907.

January 20.—Steamship *Preston* stranded on Courtown Gays, St. Andrews Island, about 170 miles from Port Limon, Costa Rica. Assistance was summoned by radio, and all on board were saved.

April 10.—Steamship *Araphahoe*, of Clyde Line, lost her propeller off Cape Henlopen, Del. The *Apache* and *Iroquois* responded to the wireless call for aid, and the vessel was towed to port.

May 8.—Steamship *Prinz August Wilhelm* stranded on Middle Ground, Kingston, Jamaica. Aid was secured by radio, and the ship with all persons on board was saved.

1908.

March 25.—The steamship *Seminole*, of the Clyde Line, ran ashore at Point Pleasant, N. J., in a heavy fog. The vessel pounded heavily on the bottom, greatly alarming the passengers. The distress call was sent out, bringing wrecking tugs and life-saving crews to her assistance.

1909.

January.—The *Republic* was sunk in collision with the *Florida*; probably 1,500 lives saved by means of radio.

January 20.—Steamship *Hamilton*, of the Old Dominion Line, was in collision with a car barg of the New York, Philadelphia & Norfolk Railroad, in Hampton Roads. Distress call was sent out by radio, and in a short time tugs were towing the badly battered steamer back to port.

February 26.—United States revenue cutter *Mohawk* ran aground on Hog Back at Hell Gate. She was leaking badly, her bow resting on two bad rocks, which threatened to tear a hole in her bottom with the fall of the tide. Wireless calls were sent which brought powerful tugs and lighters to her assistance.

March.—*Horatia Hall* disabled in Lake Michigan; 150 persons were saved by means of radio.

The schooner *Ann J. Trainer* was sighted by the Egg Harbor, N. J., life-saving station, dismantled and in a sinking condition. Wireless distress signals were flashed, in response to which rescuing tugs came to her aid.

March 8.—*City of Racine* disabled in Lake Michigan; radio was instrumental in saving 200 lives.

June 10.—The steamship *Slavonia* was stranded in the Azores, and the passengers and crew, numbering 410, were rescued from the wreck by the assistance of vessels summoned to her aid by wireless.

June 27.—The steamer *City of South Haven*, of the Chicago & South Haven Steamship Co., had her rudder torn away en route from Chicago to South Haven, Mich., and was at the mercy of a heavy sea. Assistance was secured by radio and the vessel was towed to port; 100 passengers were on board.

June 29.—The steamer *Mackinaw* of the Schubach-Hamilton Steamship Co., ran aground on the Yukon Flats. A wireless message to the steamship managers at St. Michael brought lighters to remove a portion of the cargo, after which the vessel was floated.

August 11.—The steamer *Arapahoe*, of the Clyde Line, while bound from New York for Charleston and Jacksonville, heavily laden and with many passengers on board, broke her tailshaft near Diamond Shoals and was helplessly drifting ashore. The distress call brought the steamship *Huron* to her assistance.

August 14.—The steamer *Helen*, of the Atlantic Fruit Co., went ashore off Poplar Island, Chesapeake Bay, while heavily laden with a perishable cargo of bananas. The *Helen* was not equipped with wireless, but was sighted by the tug *Savage*, which immediately sent a distress call, bringing out the necessary aid.

August 26.—The steamer *Ohio*, of the Alaska Steamship Co., while en route from Seattle, Wash., to Valdez, Alaska, via what is known as the inside passage, struck a rock at Steep Point, at the northern end of Finlayson Channel, British Columbia, sinking in 30 minutes. The S O S call had previously been sent out by Operator Egges, in response to which the steamships *Humboldt* and *Rupert City* came to the aid of the sinking vessel; of the 200 persons aboard only 5 lost their lives, Operator Egges being among the missing.

September 21.—The steamer *Caris*, of the Clyde Line, bound from New York to Wilmington, N. C., and Brunswick, Ga., with passengers and cargo, was compelled to come to anchor off Cape Hatteras when her machinery was disabled. Several ships responded to the S O S call, and the *Caris* was towed into port.

September 25.—The steamer *Zeeberg* ran ashore on the south jetty of St. Johns bar, near Jacksonville, Fla., and was pounding on the rocks when the Clyde liner *Arapahoe*, which was equipped with radio apparatus, sighted her distress signals, and sent the distress call, which brought the necessary aid.

October 13.—The steamer *Georgia*, of the Goodrich Transit Co., was rendered helpless by the loss of her propeller blades in a heavy sea and high wind when off Kewaunee, Wis. A wireless message was sent asking for assistance, in response to which a tug was dispatched from the harbor which towed the *Georgia* into Kewaunee.

November 20.—The steamer *Breakwater*, of the Atlantic Fruit Co., ran ashore in a gale 6 miles from Diamond Shoals lightships. The radio station at Cape Hatteras received the distress messages from the lightship and summoned the wrecking tugs *Merritt* and *Coley*, which took off 30 persons before the vessel was ground to pieces by the shoals.

The steamer *Alliance*, of the California & Oregon Coast Co., lost her rudder at the entrance of Goose, Oreg.; tugs were summoned by radio and the vessel was towed into port.

November 22.—The steamer *Puritan*, of the Graham & Morton Transportation Co., when off Benton Harbor, Lake Michigan, in a winter gale, was disabled by breaking the steering gear, and the vessel was buffeted about in the rough seas. The steamer *Benton Harbor* and a tug were dispatched from Ludington, Mich., in response to the distress call sent, and the *Puritan* was towed to St. Joseph, Mich.

December 1.—The steamer *Nueces*, of the Mallory Line, while bound from New York for Key West and Galveston, ran aground on French Reef, off the Florida coast, in a thick rain squall. Wireless distress calls sent through the Key West Station brought the *Lampasas* and the Government tug *Oscola* to her assistance.

December 27.—The steamer *Iroquois*, of the Clide Line, while bound from New York to Jacksonville, Fla., lost her propeller just north of Frying Pan Shoals. Wireless distress calls brought responses from 9 steamers. The *San Marcos*, of the Mallory Line, towed her to Charleston, S. C.

1910.

January 3.—The steamer *Algonquin*, of the Clyde Line, while bound from Boston for Galveston, broke her tailshaft off Cape Hatteras in a blizzard. The wireless distress call was sent, in response to which the *Apache* came to her assistance and towed the disabled vessel back to port.

January 7.—The steamer *Arizona*, of the Goodrich Transit Line, burst her cylinder heads during the night in the middle of Lake Michigan, and it was impossible to make progress through the ice flood. Wireless distress calls brought out the steamer *Indiana*, which towed her to dock in Chicago.

February 5.—The steamer *Kentucky*, a wooden vessel bound from New York to the Pacific coast, via Cape Horn, to enter the Tacoma-Alaska service, sprung a leak off Cape Hatteras. The steamer *Alamo* responded to the distress call and reached the spot just in time to prevent the captain and 46 men aboard the *Kentucky* from going down with her.

April 13.—The steamer *Santa Clara*, of the North Pacific Steamship Co., foundered off the coast of California. Before the vessel sank, 95 persons were taken off by the tug *Ranker*, which was summoned by the wireless distress call.

May 9.—The steamer *Preston*, of the United Fruit Co., plying between Mobile, Ala., and Central America, lost her propeller and was rendered helpless. A wireless message to Mobile notified the home office of the trouble, which was soon remedied.

July 20.—The steamer *Huallaga*, of the Peruvian Dock & Steamship Co., plying between Panama and Peruvian ports, was burned at sea off the north coast of Peru; no passengers' lives were lost, but three of her seamen perished. The SOS call sent brought out the steamship *Ucayali* in time to transfer the passengers and remainder of the crew.

July 23.—The steamer *Momus*, of the Southern Pacific Co., bound from New York to New Orleans, took fire south of Cape Hatteras. Capt. Boyd after fighting the fire several hours summoned aid by means of wireless, the steamship *Comus* responding, which resulted not only in the saving of many lives, but also in saving the cargo and ship, which were valued at \$3,000,000.

September 9.—Pere Marquette Car Ferry No. 18 sank in middle of Lake Michigan. The S O S call was heard by Ludington wireless station and steamer *Perc Marquette* No. 17. Later rescued four passengers and two of crew. All others lost their lives, including wireless operator, S. S. Sczpanck.

September 21.—The steamer *Western States*, of the Detroit & Buffalo Steamship Co., while on her eastern trip from Detroit to Buffalo, was disabled off Long Point, Canada, in Lake Erie. By means of the wireless station on board her captain was enabled to communicate with her owners, who promptly sent relief to the helpless ship.

October 18.—The Wellman dirigible balloon "America" was helplessly drifting over the Atlantic Ocean when the radio operator on the Royal Mail steamship *Trent* caught the wireless call for help sent from mid-air and rescue soon followed. News of the rescue was flashed to shore stations 500 miles distant and was soon published in all the newspapers.

October 28.—The steamer *Charles Nelson*, of the Chas. Nelson Lumber Co., went ashore a few miles north of Point Arena, Cal., in a thick fog. A distress call was sent which resulted in bringing the United States revenue cutter *McCullough* to her assistance.

December 1.—The steamer *Northwestern*, of the Alaska Steamship Co., was wrecked off Falee Bay, San Juan Island, Wash., while bound from Seattle to Cordova, Alaska. The steamer *Tees* responded to the SOS and all on board were saved.

December 10.—The steamer *Olympic*, of the Alaska Steamship Co., was wrecked on a reef off Bligh Island, Alaska. Government launches answered the SOS call and 123 persons were saved.

1911.

(No date.) H. M. S. *Cornwall* reported by radio as being ashore at Cape Sable, Nova Scotia, and the Donaldson liner *Saturnia* as having struck an iceberg 175 miles east of Belle Isle. Both vessels were brought safely to port.

January 2.—Capt. McGray, of the steamer *Herman Frasch*, was stricken with ptomaine poisoning and at the point of death. A wireless message was promptly sent to physicians of the United States naval stations at Dry Tortugas, Fla., about 100 miles away. The operator in the *Merida*, which was leaving the harbor of Progreso, Yucatan, about 800 miles away, caught Capt. McGray's message asking for a prescription and method of treatment. The reply written by the surgeon on the *Merida* was received on board the *Herman Frasch* before the naval station at Dry Tortugas, Fla., could respond. Capt. McGray, followed directions, prepared a remedy from his medicine chest, and soon recovered.

January 25.—The steamer *Queen*, of the Pacific Coast Steamship Co., while off Point Reyes, Cal., discovered fire in her forward hold. The distress call brought four steamers to her assistance and the crew of 87 were saved.

January 26.—The steamer *Cottage City*, of the Pacific Coast Steamship Co., was wrecked on a reef off Quadra Island, North British Columbia, in a blinding snowstorm and heavy fog. The S O S call brought aid from Victoria, British Columbia, and Port Townsend, Wash., and all on board were rescued.

April 11.—The steamer *Asia*, of the Pacific Mail Steamship Co., sank off Finger Rock, South China. Her wireless distress signals were answered by the *American Maru* and the Chinese vessel *Shang Sui*. The passengers and crew and the mails were saved.

May 12.—The steamer *Merida*, of the Ward Line, while off the Virginia Capes in a heavy fog, bound for New York from Vera Cruz and Habana, was struck

amidships by the *Admiral Farragut*, bound from Philadelphia for Jamaica. The wireless distress call was sent out and responded to by the steamship *Hamilton*, to which vessel all persons on board the two colliding ships were transferred before the *Merida* sank and the *Admiral Farragut* helplessly disabled.

June 15.—The steamer *Western States*, of the Detroit & Buffalo Steamship Co., was disabled by the blowing out of a cylinder head while in the middle of Lake Erie, bound for Buffalo. Two vessels responded to the distress call, and all the passengers, 200 of whom were members of the Michigan Bankers' Association, were saved.

November 22.—Steamship *Prinz Joachim* struck rocks at Atwood Bay, Samana Islands. Wireless communication, established direct with New York City, resulted in the saving of all on board.

December 13.—The steamship *Dclhi* was reported in distress off Cape Spartel. Assistance was obtained by wireless and all on board was safely landed.

1912.

February 22.—Steamship *Madison* rammed by steamship *Hipplayit Dumois*. Wireless was the means of saving the entire crew and all the passengers.

April.—Steamship *Denver* in collision with steamship *El Sud* off Galveston Bar. *El Sud* not equipped with wireless, but assistance was sent to *El Sud* in response to *Denver's* calls, and the wrecked vessel was towed into Galveston.

April 15.—Steamship *Titanic*, White Star Line, was wrecked. The assistance secured by wireless resulted in the saving of 703 lives.

(No date.) The steamship *Advance*, of the Panama Line, with 70 passengers on board, had part of pilot house and bridge torn away. The S O S call brought assistance from three liners and a vessel of the Revenue-Cutter Service.

August 16.—Steamship *Pleiades* ran ashore in Magdalena Bay. Operator G. Bennett summoned aid by wireless and all were saved.

October 18.—Steamship *Camino* sailed from Portland, Oreg., and ran into an 80-mile gale. Heavy seas swept the decks and the terrified passengers gathered in the saloon praying and weeping. The gale raged all night and at 5.30 a. m. of October 19 the propeller dropped to the bottom of the sea from the broken shaft. The vessel was at this time 15 miles offshore from the wind carrying her farther to sea. The S O S call was answered by the steamship *Watson* and in three hours the *Watson* was standing by ready to render relief.

December 5.—Steamship *Easton*, of the United States & Dominion Transportation Co., struck on Iroquois Reef, Lake Superior. Wireless calls were answered by stations at Port Arthur, Ontario, and Duluth, Minn. Tugs were sent to assistance of stranded steamer in answer to wireless calls and the *Easton* was released with slight damage.

1913.

January 16.—The steamship *Veronese* was wrecked on the Boa Nova Rocks about a half mile outside Lelxoes Harbor. The S O S signal was sent out and, through the aid thus secured, all but a few of the passengers were rescued.

April.—The *Texas*, bound from Christiansand to Galveston, lost her propeller and rolled helplessly about in a heavy sea for a day and a night. The *C. F. Tietgen*, of the Scandinavian-American Line, responded and effected a successful rescue.

The *Robert Dollar*, while crossing the Columbia River bar, struck heavily, and later discovered that her rudder had been broken off, leaving her helpless in a big sea and a high wind. The S O S call was sent out, and a tug in the vicinity was dispatched, which made a rescue within a few hours.

June 10.—The steamship *Olinda*, of the Munson Line, with five passengers and crew, caught fire at sea. In response to the S O S call, the U. S. S. *Nashville* went to her assistance. All the passengers were safely carried away.

June 13.—Steamship *Yukon* struck reef of Alaskan coast and sank. The radio operators summoned aid by wireless and all were saved.

June 19.—Steamship *Riverside* wrecked and sank off California coast. Wireless was instrumental in saving the lives of all on board.

July 24.—The *Milnocket* collided with the *Persian*. A tug and lighter were summoned by wireless and the vessel was docked.

August 18.—The steamer *State of California* crashed onto a reef in Gambier Bay, Alaska, and sank within three minutes. Donal C. Perkins sent the S O S

call, which was picked up by the *Jefferson*, and the survivors, who were in life-boats and on rafts, upon the arrival of the *Jefferson* at the scene of the disaster, were rescued with very little difficulty.

September 29.—The steamship *Templemore*, on a voyage from Baltimore to Liverpool, caught fire. In answer to the S O S call all steamers in her vicinity came to the rescue and all on board were saved.

October.—The *Templemore* again caught fire and completely burned. Fifty-four lives were saved by the Hamburg-American liner *Arcadia*.

The steamship *Berkshire* was burned off Lookout Cove, N. C. The distress call was heard at Wilmington, 164 miles away, by the revenue cutter *Seminole*, which reached the scene of the disaster in time to take off all the passengers, and after the flames were extinguished the following day, the vessel was towed to a safe anchorage.

October 3.—The *Spokane* went ashore on the beach off Cape Lazo, British Columbia, and summoned by wireless the freighter *La Touche*. The steamships *Dolphin*, *Minnesota*, and *Alki* also responded, but their assistance was not needed.

October 11.—The steamship *Volturmo* was burned in mid-ocean, and in response to the wireless appeal 10 vessels came to her rescue and 521 lives were saved.

October 15.—The *Mercel* was wrecked on Point Gorda, Cal., and completely destroyed. There were three replies to the S O S sent out, the *Atlas*, being the first vessel to arrive, safely transferred all on board the doomed vessel from the small boats.

October 23.—The *Stanley Dollar* struck the Viti Rocks on the Pacific coast. The distress call was responded to by the *Tahoma* and the wrecked ship was successfully hauled off the rocks on October 25.

October.—The steamship *Pleiades* met in collision with an unknown steamship off the Pacific coast. The wireless appeal for the assistance of a tug met with prompt response and the *Pleiades* reached port safely.

November 1.—The steamship *Norwega*, when 95 miles south of Hatteras, collided with the schooner *Glenlui*, tearing a hole in her side of such enormous size that she rapidly filled with water. Assistance was summoned by radio, a passenger vessel, two revenue cutters, and a battleship responding, and all on board were saved.

November 12.—The steamship *Oravia* ran on the rocks off the Falkland Islands. Assistance was called by radio and the passengers and mails were saved before the vessel was lost.

November 16.—The steamship *Balmes* caught fire. The steamship *Pannonia* responded to the S O S call, and 125 lives were saved. At the time of this rescue the crew of the *Balmes* was reduced to the last degree of exhaustion, and the firemen lay about the deck so overcome, as the result of asphyxiation, that they had to be relieved every 15 minutes.

November.—Great Lakes storms destroyed 19 vessels, none of which were equipped with wireless. All vessels having radio apparatus installed received warning of the coming storm and sought safety.

1914.

January 4.—The steamship *Oklahoma* broke midships 75 miles south of Sandy Hook. Reaching out over miles of mountainous seas the distress call, which was flashed by radio, brought rescuing vessels, which were responsible for the saving of 13 out of the 40 persons on board the wrecked vessel.

January 13.—The Royal Mail Steamship Packet Co.'s steamship *Cobequid* was stranded on Trinity Rock, in the Bay of Fundy, and 36 hours after the first wireless calls for help were sent out the 108 persons on board were rescued.

January 26.—The yacht *Warrior*, owned by Frederick W. Vanderbilt, ran aground near Savanilla, on the coast of Colombia. Assistance was summoned by radio and the owner and his guests were taken off the stranded yacht by the *Almirante*.

January 30.—The steamship *Monroe* collided with the steamship *Nantucket*; 85 lives were saved as a result of the distress call sent out by Operator Kuehne, who gave his life belt to a woman, himself sinking in the icy water some time later, thus having given his life to save another.

February.—The lumber schooner *Yellowstone*, in distress in a storm off the Pacific coast, hailed a passing vessel and asked that a wireless call for assistance be sent out. This was done, and another lumber vessel responded and succeeded in towing the *Yellowstone* to San Francisco.

The *Pectan* ran aground off Adams Cove, Cal. Three vessels responded to the wireless distress call and succeeded in pulling the wrecked ship off the rocks.

The cargo schooner *Frank B. Witherbee* was badly damaged and in a sinking condition when her signal of distress was sighted 10 miles off Highland Light. A wireless appeal flashed to the Revenue-Cutter Service brought out the *Itasca*, and all on board were rescued and the wrecked vessel safely towed to Boston Harbor.

March 17.—The *City of Sydney* was stranded on rocks near Halifax, Nova Scotia. The distress call was sent by radio, the tug *Rosemary* responding, resulting in the saving of the lives of all on board, numbering 53 persons.

May 3.—The *Columbian* was destroyed by fire in mid-ocean. Three vessels, the *Franconia*, the *Manhattan*, and the *Seneca*, responded to the S O S call and 31 lives were saved.

May 29.—The steamship *Empress of Ireland* collided with the collier *Storstad*. In response to the radio call for assistance the steamship *Lady Evelyn* and steamship *Eureka* rendered considerable aid, resulting in the saving of nearly 500 lives.

June 5.—The *Northland* ran aground on Bartlett's Reef and wireless was used to call the wrecking tug *Tasco*, which proceeded promptly to the scene of the accident.

August 17.—Steamship *Prince Albert* ran ashore on Butterworth Rocks during dense fog. Assistance was summoned by wireless and all passengers and crew were saved.

August 25.—Steamship *Admiral Sampson* sank after collision with the steamship *Princess Victoria* off Point No Point, near Seattle, Wash. Eight lives were lost. S O S sent out by *Princess Victoria* was picked up by a radio station in Seattle and also by the steamship *Admiral Watson*. A tug was sent from Seattle to the assistance of the *Admiral Sampson*.

September 1.—Steamship *City of Chicago* was reported on fire 12 miles out from Chicago. Wireless was utilized, and the ship returned safely to port.

September 18.—Steamship *Francis H. Leggett* sank 60 miles south of Columbia River. The radio station at Astoria, Oreg., intercepted a message to that effect which had evidently been sent from a foreign cruiser to a Canadian station. The Astoria station notified all ships in the vicinity to look for survivors. Two persons were rescued.

October 11.—The steamship *Almirante*, of the United Fruit Co., stranded at Cartagena Harbor; 66 passengers and 90 persons in crew. No lives lost.

October 15.—Steamship *Metapan* rammed and sunk by *Iowan* at the entrance of Ambrose Channel, New York. S O S was answered by vessels in various parts of the harbor.

October 28.—The steamship *Proteus* sent S O S call, which was answered by the revenue cutter *Miami*. Later found that assistance was not needed, however.

November 10.—Steamship *Lakeland* ran ashore 8 miles from Alpena. Radio operator sent out distress signals, which were answered by shore stations at Cleveland, Buffalo, and Tobermory. The tug *Favorite* was informed and went to *Lakeland's* assistance. Constant communication was maintained between the tug and the distressed vessel.

November 23.—Steamship *Hanaiei* struck on reef near Bolinas, Cal. S O S answered by radio station at San Francisco, revenue cutter *McCulloch*, and oil tankers *El Segundo* and *Richmond*. Heavy seas and reefs prevented their going to assistance of the distressed vessel, which was slowly being pounded to pieces. The wireless cabin was washed away, but Operator Lovejoy established communication with shore by means of pocket flashlight and directed work of rescue. Forty-three persons were saved.

December 8.—The steamship *Momus* sent out S O S call because of steering gear being damaged. The tug *El Ray* went to her rescue.

December 11.—The steamship *Centralia* requested assistance by radio. The steamships *Harvard* and *Bear* responded to the distress call.

December 19.—The steamship *Isthmian* struck rocks off San Benito Island. In response to the S O S call the cruiser *West Virginia*, torpedo-boat destroyer *Perry*, and the Navy tug *Iroquois* proceeded to the rescue.

December 22.—The steamship *Honolulu* ran aground. The accident was reported by wireless, and six tugs went to her aid.

December 30.—Steamship *Colorado* became disabled off Little Egg Harbor, N. J.; crew of 35; no loss of life. In answer to wireless calls tugs brought vessel into New York.

1915.

January 1.—The steamship *Obdulse* struck Shipwash Sands. Call for assistance was sent by radio, and several ships responded, resulting in the saving of the entire crew, numbering 42 persons.

January 8.—The yacht *Wakiva* ran ashore on breakwater at Tampico, Mexico. Wireless call was responded to by several ships and all on board were saved.

January 10.—Steamship *Mexicano*, Pierce Navigation Co., ran ashore on Tampico, Mexico, Breakwater. The radio operator sent out wireless distress calls, which were answered by Mexican Government station at Tampico. The vessel was floated by tugs.

January 13.—The steamship *Colorado*, Wilson Line, reported to her agents by radio she had been damaged in collision. She was able to return to port under her own steam, however, assistance not being required.

January 18.—The steamship *Camino* was helplessly adrift at sea. The Canadian Government steamer *Lady Laurier* and other vessels which heard her call for aid proceeded to the rescue.

January 24.—The steamship *Washington* was sunk by schooner *Elizabeth Palmer*. One life was lost, and 53 persons were rescued by the steamship *Hamilton*, of the Old Dominion Line, which responded to the distress call.

February 4.—The steamship *Iowa* was crushed by an ice jam off Chicago Harbor. Tugs were summoned by wireless and the entire crew of 25 was saved.

February 4.—Steamship *Colon* stranded off bar at Topolobampa. S O S call answered by U. S. S. *Maryland*, *Korrigan III*, and the U. S. S. *Annapolis*. Passengers and crew were transferred to the *Maryland* and the *Annapolis*.

February 4.—The oil tanker *Chester*, though not equipped with wireless, attracted the attention of the American liner *Philadelphia* by sending the S O S on Morse lights. The radio operator of the *Philadelphia* established communication by this means and 33 men were rescued from the sinking ship.

February 19.—The steamship *Santa Marta* lost rudder in a gale and was in need of immediate assistance. The S O S call summoned the necessary aid.

March 6.—Steamship *La Touraine*, bound from New York to Havre, with an inflammable cargo, was discovered on fire on the morning of March 6. The vessel was 400 miles west of the Irish coast. The S O S call was answered by the steamships *Arabic*, *Cornishman*, *Swanmore*, and *Rotterdam*. The fire was finally gotten under control by the crew. However, the *Rotterdam* remained near by ready to take off the passengers of the *La Touraine* should this be found necessary. The appeal for help was heard by a British cruiser, which vessel also responded to the call for assistance, but when she reached the *La Touraine* assistance was not necessary. The *La Touraine* was convoyed as far as Prawle Point by the steamship *Rotterdam*, and two French cruisers escorted the injured vessel as far as Cherbourg.

March 18.—The steamship *Santa Ana* was disabled on account of boiler trouble off Kodiak Island, Alaska. The steamship *Windber* responded to the S O S call, and no lives were lost.

March 23.—The steamship *Denver*, of the Mallory Line, when 1,300 miles from New York, sunk. Ten vessels responded to the S O S call, and all on board, numbering 65 persons, were saved.

March 25.—The steamship *Peristan* grounded in Mississippi River. While in this position she was struck, on March 27, by the steamship *Heredia*, of the United Fruit Co. Wireless brought prompt aid to the two distressed vessels.

March 27.—The steamship *Heredia* struck the steamship *Paristan*. (See above.) The *Heredia* had 164 passengers aboard.

March 30.—The steamship *Balmes* was stranded on reef 30 miles west of Key West, Fla. A call for assistance was sent by radio and all on board were saved.

April 1.—Steamship *Mexico*, Pacific Steam Navigation Co., ran aground near Southwest Pass, La. Wireless was instrumental in bringing tugs to float vessel.

April 14.—The steamship *Seminole* wrecked off Yuma Bay. Wireless was utilized, but passengers reached shore safely before rescuing vessels arrived.

April 21.—Steamship *San Zefero* grounded in Galveston Harbor; crew of 40 aboard. Wireless was used to report, but vessel was found to be in no danger.

April 11.—The steamship *Minnesota* was stranded at entrance to Japanese Inland Sea. Three vessels responded to the S O S call, and the ship, with all on board, was saved.

April 29.—The *Edgar H. Vance* was in danger of sinking just outside San Francisco Harbor on account of rudder breaking. A distress call was sent by radio and the vessel responding brought the necessary assistance; no lives were lost.

May 7.—The steamship *Lusitania* was torpedoed by a German submarine 10 miles from Kinsale, Ireland. Several ships responded to the S O S call, and 754 lives were saved.

May 7.—The steamship *Asuncion* ran ashore off Fraser River. Wireless was utilized in summoning tugs to her assistance.

May 18.—The steamship *Standard*, while out at sea in latitude 22° 50' north, longitude 88° 18' west, discovered fire in oil-fuel bunkers. Assistance was summoned by radio. Four vessels responded, and the *Bradford* towed the disabled vessel into Key West.

May 26.—Collision between the Holland-American liner *Ryndam* and the fruit steamer *Joseph J. Cunco*, south of Nantucket Shoals. The S O S call was answered by the battleships *South Carolina*, *Texas*, *Louisiana*, and *Michigan*. The *South Carolina* took aboard the 230 passengers of the *Ryndam* who had been transferred to the *Cunco*. No lives were lost.

May 31.—The steamship *Seward*, when 35 miles off Cordova, Alaska, listed badly on account of shifting of cargo. Two ships, 50 and 80 miles distant, answered immediately. All on board were saved.

June 3.—The steamship *Alliance* was stranded at Richmond Beach, Wash. Tugs responded to the S O S call and all on board, numbering 40 persons, were hauled off successfully.

June 9.—The steamship *A. W. Perry* ran ashore at Chebucto Head, Nova Scotia. Shore stations answered call for aid, and arranged relief vessels. All on board, numbering 82 persons, were saved.

June 13.—The *Bunker Hill* collided with yacht *Venadis* off Eaton's Neck, Long Island Sound, as a result of which two persons were killed and several were injured. Aid was called for by radio, and the remainder of the passengers and crew were saved.

June 16.—Steamship *Alabama* was struck by steamship *Delaware* 53 miles south of Scotland lightship in dense fog. Neither vessel, however, was badly damaged. Wireless was used to notify owners.

June 28.—The *California* ran ashore at Tory Island. The distress call was sent by radio, and a British destroyer responded, bringing the necessary assistance.

July 2.—Steamship *Panuco* grounded at entrance to South Pass, La.; crew of 35 aboard. Wireless used to bring prompt aid to float vessel.

July 10.—The pilot boat *New Jersey* was rammed and sunk by the United Fruit steamer *Manchioneal* at the eastern entrance to Ambrose Channel. The steamship *Manchioneal* saved the crew, but the S O S calls sent out brought assistance which was not needed.

July 11.—The *Invermore* was wrecked near Brig Harbor, Labrador. The distress call was sent by radio and the necessary aid was obtained.

July 22.—The steamship *Sucha*, while on fire in the Gulf of St. Lawrence, signaled for help by wireless, which was received by the *Royal George*, and which vessel proceeded to the rescue of the *Sucha*, but later received word by wireless that the fire had been put out and that help was not needed.

August 2.—The steamship *Georgian* went aground off Duxbury Reef. The steamship *Harvard* responded to the S O S call and all on board were saved.

August 4.—The *Emma Angel* was storm-battered and water-logged 45 miles southeast of the Highlands, and signaled to the *Bermudian* near by, which sent a wireless distress call, to which the *Seneca* responded, and all on board were saved.

August 18.—The *El Sud* grounded on Galveston Bar. The tug *Senator Bailey* responded and brought the necessary assistance.

August 23.—Steamship *Metapan* grounded in Cartagena Harbor. There were 45 passengers and 19 in crew. The cargo was promptly discharged into lighters and steamer subsequently floated.

August 30.—The *Faith*, of the Alaska Steamship Co., when 40 miles northeast of Cape St. Elias, listed badly on account of shifting of cargo of copper concentrates. The S O S call brought the necessary aid and all on board were saved. The fate of the vessel, however, has not been definitely learned.

September 15.—Steamship *Sant Anna*, of the Fabre Line, was on fire in mid-ocean, latitude 40° 23' north, longitude 47° 30' west. The S O S call brought

the *Ancona*, which took off 600 persons and conveyed the distressed vessel to port. The *Sant Anna* carried 1,700 persons in addition to the crew.

September 19.—The steamship *Athina* was destroyed by fire in midocean, latitude 40° 54' north, longitude 58° 47' west. The *Tuscania* and *Romanian Prince* responded, resulting in the saving of 470 lives.

October 8.—The steamship *Mariposa* grounded and sank on rocky shore in Llama Passage, off Pointer Island, British Columbia. The S O S call was heard by two vessels. The *Despatch*, being within 30 miles, responded and safely carried off the 139 persons on board.

November 2.—The steamship *Santa Clara* was wrecked on jetty at Coos Bay, Oreg. Wireless succeeded in bringing out a vessel to the aid of the wrecked ship, and 93 persons were saved.

November 5.—The steamship *Fort Bragg* grounded in Gulf of California. The U. S. S. *San Diego* responded to the distress call, and 47 persons were saved.

November 8.—The steamship *Rochambeau* caught fire at sea and sent S O S call by wireless; later, however, she sent another message stating that fire was under control.

November 9.—Steamship *Liebatia* (Italian), loaded with cased kerosene and gasoline, caught fire 65 miles east of Sabine Bar, Tex. Reported by wireless by steamship *Gulfstream*, which vessel stood by the burning steamer until other assistance, summoned by wireless, arrived from Port Arthur and Galveston. Without the assistance thus secured the vessel and cargo would have been a total loss.

November 27.—The steamship *Thessaloniki* sprung a leak about 400 miles southeast of Sandy Hook. Several vessels responded to the distress call, and 300 persons were saved.

December 1.—The steamship *Minnesota*, when 760 miles south of San Francisco, sent wireless stating that machinery was disabled. The necessary aid was rendered by the *Iroquois* and the tug *Dauntless*, which responded promptly upon hearing the distress call.

December 1.—Steamship *Flamenco* ran aground at South Pass, La. The accident was reported by wireless and rescue soon followed.

December 13.—Steamship *Antilla* collided with a barge beached off Sea Gate. Wireless was instrumental in saving the cargo.

1916.

January 1.—Steamship *Vandeggen*, not equipped with wireless, showed signals of distress, which were seen by the steamship *Muskogee*. Message sent broadcast giving position of disabled steamer, which was later towed to port.

January 17.—Car ferry *Pere Marquette No. 19* went aground 4 miles north of Ludington, Mich., 7.40 p. m. Wireless communication established with Ludington and *Pere Marquette* car ferries Nos. 17 and 18, which were advised not to come in close on account of shoal water. Wireless used throughout salvage operations.

January 19.—Steamship *Pollentia*, 706 miles off Cape Race, in latitude 36° 30', longitude 35° 04', sinking, called S O S. Immediately answered by steamships *America*, *Giuseppe Verdi*, *Moncenisio*, *Westerdyk*, and *Narragansett*. Crew of 35 rescued by boats from *Giuseppe Verdi*, while *Narragansett* poured oil on waves.

January 22.—Steamship *Centralia*, off Columbia River, heavy seas washed away deck load, broke rudder, and flooded engine and wireless rooms. Aerial carried away, but repaired by operator, who then called S O S. Answered at once by steamships *Governor*, *Adeline Smith*, *Yosemite*, *Admiral Schley*, *Eurona*, and land stations at Marshfield and Eureka. Weather and sea finally moderated and ship made San Francisco safely without assistance.

January 23.—Steamship *Brazos* and steamship *Suffolk* in collision 23 miles southeast Scotland Light in dense fog. Wireless communication informed agents of accident and vessel returned to New York for repairs.

January 24.—Steamship *Frank H. Buck* when 355 miles north of San Francisco lost her rudder. Wireless used to summon aid.

January 24.—The newspapers report the British steamship *Pollentia* in distress about 700 miles off Cape Race, according to a wireless message which has been received at Halifax, Nova Scotia. The captain and crew of the *Pollentia* were saved by boats from the *Giuseppe Verdi*. In response to the wireless signals for help, several steamers came to her rescue, and for four days the *Giuseppe Verdi* stood by giving such assistance as possible. At no

time was there any hope of saving the *Pollentia*, but attempts to take off the crew were deferred because of the gale and tremendous seas. It was finally possible to rescue all on board the *Pollentia* and soon thereafter the disabled vessel sank.

January 26.—Steamship *Proteus* in collision with steamer *Brabant* below the Narrows, New York Harbor. Wireless messages informed agents of accident, which, however, was not serious.

January 30.—Steamship *Philadelphia* in collision with sailing ship *Ben Lee* 12 miles south of Carnavon Bay. Wireless used in notifying agents of accident.

February 1.—Steamship *Takata Maru* in collision with steamship *Silver Shell*; S O S answered by radio stations at Boston and Cape Race and various steamers. Crew rescued by *Silver Shell*.

February 4.—Steamship *Texas* (Swedish) reported by radio that cargo of cotton was on fire. Later reported fire under control and assistance not required.

February 4.—Steamship *Howard* in collision with barge off Point Judith. Barge sunk. Wireless used to notify owners of accident.

February 7.—Steamship *Harvard* rammed the steam schooner *Excelsior* in San Francisco Bay. Wireless calls brought immediate assistance from shore.

February 7.—Steamship *Caloria* ran aground head of South Pass, La. The distress call brought a number of tugs and lighters to her assistance.

February 15.—Steamship *Parlof* struck an uncharted reef at 9.01 p. m. between Tugidak and Sitkanak Islands. At 9.12 p. m. S O S call was sent out and communication established with the naval radio station at Dutch Harbor. At 10 p. m. the *Parlof* raised the naval radio station at Kodiak. The steamship *Alameda* was summoned from Cordova to the assistance of the distressed vessel, which had previously lost her propeller, and towed her to anchorage.

February 21.—Steamship *Middlesex* reported ashore inside Cross Rip. The radio operator on the steamship *Nacooche* notified the revenue cutter *Acushnet* at Woods Hole, which in turn informed the owners, thus obtaining the necessary assistance.

February 24.—Steamship *Polarine* went ashore on the 23d of February near Helsingborg. In answer to wireless distress call the steamship *Pioneer*, from Copenhagen, proceeded to assistance of stranded vessel.

February 24.—Steamship *Cretan* struck by steamship *Dorothy* 3 miles southeast Wimble Shoal buoy. S O S call sent out and answered at once by several ships. Later found assistance not required, as passengers were transferred to *Dorothy*, which was towed in by United States revenue cutter *Onondaga*. Communication with Marconi stations at Hatteras and Virginia Beach throughout.

February 28.—Steamship *Jniata* went ashore in Vineyard Sound, Mass. Communication was established by radio and repairs directed by means of wireless.

February 28.—The French auxiliary cruiser *Provence II* (so designated to distinguish her from the French battleship *Provence*) was torpedoed and sunk in Mediterranean Sea. French and British patrol boats, which were summoned by wireless, rescued 870 persons.

February 29.—Steamship *Multnomah* struck on Viti Rock off south end of Lummi Island in heavy fog. Wireless communication established with radio station at Seattle and accident reported. Vessel backed off rock and returned to Bellingham and beached in mud flats.

March 4.—Steamship *Apache*, 45 miles off Cape Henry, had machinery disabled and anchored in 25 fathoms. In answer to wireless message wrecking tugs towed her to port.

March 5.—Steamship *Principe de Asturias* foundered off Ponta Boi, near Santos. In answer to distress calls the steamship *Vega* rescued practically all of the passengers and crew, of whom there were about 1,000.

March 14.—Steamship *Kanacha* sprang a leak and sank off the coast of South Carolina. The steamship *Santa Marta* picked up 21 of crew and notified other steamers by wireless to search for the other boat containing 7 of the crew.

March 14.—Steamship *Motano* grounded off Burrwood, La. Two tugs and three lighters responded to the distress call, with the aid of which the vessel was floated. There was no loss of life or damage to the vessel.

March 16.—Steamship *Zealandia*, of the Fiske Trading Co., in distress 300 miles off Sandy Hook with steering gear disabled. Wireless messages telling of the plight of the steamship relayed to radio station at Miami by the Standard Oil steamer *Richmond* and assistance sent to the disabled steamer.

March 16.—Steamship *Macona* ashore on Barbuda Island, British West Indies. Owners notified by wireless and arrangements made with wrecking company to send tug to relief of stranded steamer.

March 16.—Steamship *Sanonofre* ran short of coal during blizzard off Newfoundland coast, 500 miles from Halifax. In response to wireless calls was taken in tow by steamship *Ashtabula* and was towed to Halifax.

March 16.—Steamship *Cubantia* sunk by mine or torpedo near Noorhinder lightship. Wireless calls for help sent out were first picked up at the Hook of Holland. All passengers and crew rescued.

March 20.—Steamship *Strombus* grounded across Southwest Pass Channel, 250 feet inside bell buoy. Several tugs responded to the distress call and succeeded in floating the vessel.

March 21.—Steamship *Bradford* leaving San Francisco had an accident to her rudder. Communication was established with the radio station at San Francisco and messages exchanged calling for assistance of vessels.

March 22.—Steamship *Minneapolis* sunk by submarine in the Mediterranean. Wireless S O S calls sent out stating that the *Minneapolis* had been torpedoed and was sinking. Calls answered by *Leicestershire* and other vessels, which went to the aid of the sinking steamer.

March 23.—Steamship *Alamo*, 130 miles northeast of Cape Hatteras, with a broken rudder and her engine disabled. Sent out wireless calls for help. A wrecking tug was sent to her assistance from Norfolk.

March 23.—Steamship *Svaland*, in latitude 44° north, longitude 55° 30' west, dismantled. Steamer *Murjek* reported a large crew on board and asked that tug be sent to assistance of distressed vessel.

March 27.—Steamship *San Cristobol*, owned by the Anglo-Mexican Petroleum Products Co., burned near her pier at Puerto, Mexico.

March 28.—Steamship *Rotterdam* grounded Southwest Pass Channel near bell buoy, with a crew of 36 on board. Several tugs responded to the distress call, and the vessel was floated March 30.

March 29.—Steamship *Siberia*, latitude 51° 8' north, longitude 7° 3' west, Irish Sea, received S O S calls from British cruiser. In response the *Siberia* gave general distress call, which brought British destroyers to her assistance. The cruiser had been torpedoed by a submarine.

March 31.—Steamship *Chiyo Maru* grounded during fog on the Lema Islands. Wireless calls summoned nine tugboats and launches and a British torpedo-boat destroyer, taking off 299 passengers.

April 2.—Steamship *Enterprise* broke her main shaft and damaged her stern. Wireless communication established with steamer *Manoa*, 150 miles away, and constant communication maintained all day until 8.30 p. m., when *Manoa* came alongside disabled steamer and took her in tow.

April 5.—Steamship *Patria*, of the Fabre Line, at 9.45 a. m. called S O S when 20 miles southwest Spartivento Sardinia, Torpille Manguée. The steamship *Siberia* answered and would have hastened to aid of the *Patria* if necessary, but at 10.30 a. m. the *Patria* sent word by radio that her assistance would not be required, as the torpedo which had threatened the boat had missed her.

April 6.—Steamship *Zent*, of the Elder Line torpedoed at Fastnet. Wireless calls for help sent out before vessel sank brought assistance and most of the crew were rescued.

April 8.—Steamship *Madison*, Old Dominion Line, standing by two barges off Long Branch, N. J., flying distress signals. At 6.15 p. m., rescued five men from one barge and called the Coast Guard cutter *Mohawk* from New York to assistance of others.

April 8.—Schooner *Emma F. Angell*, latitude 37° 43', longitude 75° 08', sunk in collision with steamer *Cheptow Castle*. Crew of schooner rescued by latter. Accident reported by radio.

April 9.—Steamship *Guajara*, with passengers and freight from Rio for New York, 301 miles south of Scotland Light, badly disabled. Wireless calls brought the steamship *Siraola*, which vessel towed the disabled liner to Norfolk.

April 10.—Steamship *San Ramon*, Pacific Coast Line, lost her propeller at 3.30 a. m. Wireless messages through the radio station at San Francisco resulted in the sending of tugs to the assistance of the disabled steamer.

April 15.—Steamship *Wm. P. Hood* reported in distress 57 miles southwest of Five-Fathom Bank lightship by steamer *Jamestown*. Revenue cutter *Mohawk*, in answer to wireless messages, went to assistance of disabled vessel.

April 15.—Schooner *Mary E. Morse* off Hatteras in distress. Steamship *Lenape* standing by a schooner and notified Norfolk by radio that dismantled schooner wished to be towed to port.

April 18.—Schooner *Millie R. Frank* observed by steamship *Madison* flying distress signals. The *Madison* informed the Coast Guard cutter *Mohawk* by wireless of the schooner's plight, which went to assistance of schooner. The crew was rescued by Toms River coast guards.

May 8.—Steamship *Philadelphian* collided with the Fire Island lightship. Communication was established by radio with the Sea Gate station, requesting that relief be sent at once. Wireless calls were responded to by the Coast Guard cutter *Mohawk*, and the damaged lightship taken in tow by the *Philadelphian* and brought to port.

May 9.—Steamship *Roanoke*, North Pacific Steamship Co., foundered and sank sometime during daylight hours. The operator, together with 47 others, lost his life; only 6 survivors were rescued. Two open boats were picked up by the steamer *Edgar Vance*, which notified shore stations of disaster.

May 11.—Barge *Ivic*, of the New England Coal & Coke Co., rammed and sunk in Hampton Road by steamer *Berkshire*. The *Berkshire* ashore on Hampton bar. The crew of barge rescued by steamer and owners notified of accident by radio.

May 14.—Steamship *Kandahar* on fire in Ambrose Channel. Facts reported to agent, who promptly sent fire boat from New York to assistance of burning vessel.

May 15.—Steamship *San Giovanni* and steamship *Grekland* in collision in a fog in Ambrose Channel near Sandy Hook. The *San Giovanni* established wireless communication with the station at Sea Gate and reported the accident. The United States Coast Guard cutter *Mohawk*, steamship *Portuguese Prince*, and steamship *Roma* went to assistance of distressed vessels.

May 19.—Steamship *Catania* went aground during heavy weather at Aransas Pass Bar, Tex. S O S signals promptly answered by radio station at Galveston, from which point a large tug was immediately dispatched to the distressed vessel. The tug succeeded in floating the *Catania* and towing her to Aransas docks. It is probable that without the prompt assistance secured by radio the vessel would have broken up, as a heavy gale was blowing.

May 29.—The bark *Joaquina*, when 51 days out of Alicante, Spain, found herself dangerously near rocks, entrance to harbor Guantanamo, Cuba. The steamship *Antilles* discovered her plight and summoned a tug to her assistance by wireless.

June 14.—Steamship *Bear*, of the San Francisco & Portland Steamship Co., was wrecked off Cape Mendocino during the evening, the vessel grounding on a rock in a dense fog. The steamers *Queen*, *Grace Dollars*, U. S. S. *Oregon*, and the tug *Relief* responded to the distress calls sent. Five lives were lost as a result of capsizing of some of the lifeboats in the surf, while 200 passengers and crew were saved.

July 11.—Steamship *Ramos* foundered in gale while en route from Philadelphia to Cartagena, Colombia. S O S calls were answered by the Miami land station and the steamships *Van Hogendorp* and *Illinois*, all but five persons on board being saved.

July 22.—Steamship *Matatua* stranded on rocks 7 miles south of St. Marys Light, Cape Race. Vessel shot line to shore and passengers and crew were removed. The distress call was answered by the steamship *Stephano*, Red Cross Line, which stood by until passengers were safely removed.

September 15.—Steamship *Congress*, with 445 persons on board, caught fire off Coos Bay, Marshfield, Oreg. The vessel was headed toward shore, S O S calls being sent out continuously, which were received by the land stations at Marshfield, Oreg.; Cape Blanco, Oreg.; and Eureka, Cal.; and the steamship *F. A. Kilburn*. Rescue vessels were dispatched by the Marshfield station, and all persons on board were saved.

September 23.—Steamship *Bay State* ran ashore off Cape Elizabeth, Me.; total loss. Distress calls were answered by the Coast Guard cutter *Ossipee* and the naval station at Cape Elizabeth, which dispatched the tugs *Portland* and *Cumberland*. All persons on board, approximately 200 in number, were saved.

October 7.—Steamship *Antilla*, with 56 persons aboard, caught fire off the Virginia Capes while en route from Guantanamo, Cuba, to New York. Approximately 25 vessels responded to the distress calls, and all persons were saved.

October 19.—Steamship *Aarapahoe* lost her rudder 25 miles north of Cape Lookout. S O S calls were answered by the steamship *Henry R. Mallory* and the Coast Guard cutters *Seminole* and *Tampa*, which towed the vessel to Norfolk.

October 28.—Steamship *Chicago*, with 265 passengers and crew, caught fire at sea and arrived safely at the Azore Islands. Communication was established with vessels, but assistance was not needed.

October 29.—Tug *Vigilant*, disabled 150 miles off Irish coast. S O S call answered by the steamship *Ryndam*, which towed the tug to Queenstown.

November 25.—Steamship *Powhatan*, en route from Boston to Baltimore, caught fire off Block Island. Fire was controlled before arrival of Coast Guard cutters, which answered the distress call.

November 27.—Steamship *Niels Nielson* lost propeller in heavy gale. Distress calls were answered by several vessels, which assisted the disabled vessel to make port.

November 28.—Steamship *Coronado* lost propeller off Tillamook Head. Distress calls answered by Astoria (Oreg.) station, which dispatched tug to assistance of disabled vessel.

December 3.—Steamship *Carolina*, Goodrich Transit Co., struck rocks off entrance to Sturgeon Bay Canal. Distress calls were received by the Manitowoc (Wis.) station, which dispatched a tug to the assistance of the disabled vessel.

December 12.—Steamship *Sumner* grounded in fog off Barnegat, N. J. Six vessels responded to S O S calls, and all persons on board were rescued.

December 14.—Steamship *Powhatan*, en route from Norfolk to Boston, sank in collision with unknown vessel on way to open sea. Several United States destroyers, Coast Guard cutters, and steamship *Jamestown* answered S O S calls. Crew transferred to Coast Guard vessels, and passengers were taken to New York on the steamship *Jamestown*.

December 25.—Steamship *Maryland* sank at sea 380 miles east of Sandy Hook with crew of 34. Distress calls answered by several Coast Guard cutters, but were unable to locate the disabled vessel.

[From the Radio Service Bulletin of the Bureau of Navigation, Department of Commerce, for Nov. 1, 1916.]

Radio stations of the United States.

GOVERNMENT, COMMERCIAL, AND SPECIAL LAND STATIONS.

Controlled by—	General public.		Limited public.		Limited commercial.		Special.		Government official.		Total.	
	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916
United States Navy.....	21	24	1	1	.....	.....	.....	.....	33	32	55	57
United States Army.....	9	9	.....	.....	.....	.....	.....	.....	39	45	48	54
Philippine insular government.....	6	6	.....	.....	.....	.....	.....	.....	.....	.....	6	6
Marconi Co.....	45	44	4	6	10	9	1	1	.....	.....	60	60
National Electric Signaling Co.....	2	2	1	1	1	1	.....	.....	.....	.....	4	4
Tropical Radio Telegraph Co.....	2	2	.....	1	.....	1	.....	1	.....	.....	2	5
Federal Telegraph Co.....	3	5	4	5	1	2	.....	.....	.....	.....	8	12
Mutual Telephone Co.....	3	1	.....	2	2	3	.....	.....	.....	.....	5	6
Unclassified.....	7	10	3	2	32	39	127	193	2	4	171	243
Total.....	98	103	13	18	46	55	128	195	74	81	359	452

SHIP STATIONS.

Controlled by—	Number.		Controlled by—	Number.	
	1915	1916		1915	1916
United States Navy.....	228	233	Alaska Steamship Co.....	12	12
United States Coast Guard.....	24	25	Standard Oil Co.....	11	10
United States Army.....	51	50	Panama Railroad Co.....	.....	5
United States Department of Commerce.....	7	8	Pacific-Alaska Navigation Co.....	5	5
Marconi Co.....	367	414	Federal Telegraph Co.....	5	17
National Electric Signaling Co.....	20	20	Atlantic Communication Co.....	3	5
Tropical Radio Telegraph Co.....	21	21	Unclassified.....	120	76
American-Hawaiian Steamship Co.....	21	19	Total.....	895	920

Radio stations of the United States—Continued.

AMATEUR STATIONS.

District and headquarters.	Number.		District and headquarters.	Number.	
	1915	1916		1915	1916
1. Boston, Mass.....	542	832	7. Seattle, Wash.....	203	215
2. New York, N. Y.....	636	840	8. Detroit, Mich.....	785	945
3. Baltimore, Md.....	682	821	9. Chicago, Ill.....	515	769
4. Savannah, Ga.....	54	103			
5. New Orleans, La.....	56	116	Total.....	3,836	5,255
6. San Francisco, Cal.....	363	614			

SUMMARY.

Kind of station.	1915	1916	Kind of station.	1915	1916
Government land stations.....	109	117	Other land and ship stations, except general and restricted amateur land stations.....	834	939
Other land stations, except general and restricted amateur.....	249	335			
Total.....	358	452	Total.....	1,253	1,372
Government ship stations.....	310	316	General and restricted amateur stations.....	3,836	5,255
Other ship stations.....	585	604			
Total.....	895	920	Grand total.....	5,089	6,627
Government land and ship stations.....	419	433			

The following letter was received from Commander Todd on February 1, and the committee authorized the chairman to insert same in the record:

NAVY DEPARTMENT,
Washington, January 31, 1917.

SIR: My attention has been called to certain letters and statements in the printed hearings, on which I submit the following information in order that the committee may have a clearer understanding of the points involved; points which could not all be covered in my oral statement.

Referring to the letters from John Wanamaker, published on page 217, part 3, I shall append to this letter the report of a special board ordered to investigate thoroughly this question of interference in New York and Philadelphia between the Wanamaker stations and the navy yard stations in those cities. From this report have been eliminated certain recommendations made by the board looking to the possible reduction of the amount of interference, which I consider should not be published. Briefly, the report shows conclusively that the operation of an inefficient transmitter at the Wanamaker store in Philadelphia, using unnecessary power and old-type receivers, prevented use by naval ships and stations communicating with the Philadelphia Navy Yard of all wave lengths between 1,200 and 2,400 meters; and at New York the navy yard station was prevented from getting full use of all wave lengths between 1,000 and 2,400 meters by a similar set on the New York Wanamaker building. On account of this Wanamaker interference, the work of the New York and Philadelphia navy yard stations has been restricted for years, as indicated above, and having no recourse except a division of time, we have reduced the work of those stations to a minimum. The radio sets in the Wanamaker stations are practically the same as those complained of four years ago when the present radio act was being considered, but I am informed that the transmitters comply with the decrement regulations of the radio act.

In this connection, I desire to quote the following from the "Hearing before the Subcommittee of the Committee on Commerce, United States Senate," dated Friday, March 1, 1912:

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Mr. TODD. Suppose a ship with a powerful equipment coming into the port of New York makes up her mind that she wants to talk with somebody in Philadelphia. Should she be allowed to send a full-power message going into that port, or should she communicate with the local stations? She may also want to send with full power to some station down the coast. In a harbor where a lot of wireless business is being carried on, it would not be right for one station to use a tremendous amount of energy and drown out all the others.

There is one peculiar thing about wireless communication which I have barely mentioned previously. Despite any difference of wave length, if powerful stations work within 5 miles of one another, we will say, one station can not receive satisfactorily while another is sending.

For instance, take the situation in the city of Philadelphia. Mr. Bottomley's company has on John Wanamaker's store a powerful wireless set. We have official reports in the Navy Department showing that in spite of difference of wave lengths of 800 meters, the Philadelphia Navy Yard can not receive a message from a ship when the wireless set on John Wanamaker's store is sending a message.

The CHAIRMAN. That is a difference in the length of 800 meters?

Mr. TODD. Yes, sir; and the powerful stations force oscillations on the aeri-als of the other stations on account of proximity.

The CHAIRMAN. That is, the more powerful the wave length, the greater the domination from those wave lengths?

Mr. TODD. Yes, sir. They can both send together or both receive together, but when one is sending the other can not receive. That is the danger of allowing ships to use much power when going into or out of ports when a lot of wireless business is going on.

If I wish to talk to another person in this room I would talk in an ordinary voice; but if there were several conversations going on and I wanted to talk to some one in the next room and insisted upon talking in a very loud tone of voice, drowning everybody else out, you would all be interrupted and annoyed.

The CHAIRMAN. It is for the protection of the business of the naval or military stations, rather than the protection of the general business?

Mr. TODD. The mutual protection of all stations from one another. I put in those naval and military stations because we happen to have stations at all the principal cities, and that was one way of covering it.

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The CHAIRMAN. Mr. Commander Todd, do you now attach any great importance to this section (14), from the Government standpoint?

Mr. TODD. It is extremely important on account of the instances I have mentioned of those powerful Marconi stations on Mr. John Wanamaker's stores in Philadelphia and New York. They transact commercial business over land. They say it saves them a lot of money, and other people say it is an advertising scheme. But the fact remains that we have official reports from the commandants at New York and Philadelphia saying that when the nearest station is sending to the other, neither the navy yard at Philadelphia nor the navy yard at Brooklyn, about 3 miles from the stations in the respective cities, can receive from each other or from any ship of the Navy.

The standard wave length for a shore station is 1,000 meters, differing 400 meters from Mr. Bottomley's.

Mr. BOTTOMLEY. They are not Marconi stations; they belong to John Wanamaker. We have nothing to do with them. Wanamakers work them for themselves. I do not want the impression to stand that we are working those in any way for ourselves. I say this simply for the purpose of correction.

Mr. TODD. You furnished us with a list of the Marconi stations, and in that list you show these two Wanamaker stores as Marconi stations.

Referring to the testimony on page 367, I invite attention to the statement made (which includes messages sent and received) concerning the traffic handled by the three busiest stations at the greatest port of the United States for 10 days—December 22-31, inclusive. The Bush Terminal Station handles work principally with Sound steamers at night and does a small amount of overland business; the Sea Gate Station handles the work of ocean-going

steamers, coastwise and trans-Atlantic, entering and leaving New York (constant service), while the Wanamaker Station handles only overland traffic with Philadelphia concerning the business of the John Wanamaker stores, generally between the hours of 8 a. m. and 5.30 p. m. From the figures given it appears that the three stations together handled in 10 days 150 messages, or 3,100 words, per day. This was intended to illustrate the volume of traffic, and it probably represents something higher than the average amount of traffic, radio communication being much more satisfactory at this season of the year than during the warmer months, and Wanamaker business is presumably heavier during the holidays. The average for the three stations is $2\frac{1}{2}$ messages per station per hour, or 43 words per station per hour. The Sea Gate messages averaged 15.5 words each; the Wanamaker messages were longer, averaging 27 words each. The messages from the Bush Terminal Station averaged 11.2 words. Our reports show that the Wanamaker work is nearly all done between 8 a. m. and 5.30 p. m. and that these stations in New York and Philadelphia are quite busy during those hours. Naturally, their work on a wave of about 1,800 meters does not interfere with the ship work on 600 meters of the Sea Gate and Bush Terminal Stations, but is much closer to the Government wave lengths used by the New York, Philadelphia, and Washington stations and the larger ships of the Navy.

The work between the Wanamaker stores should be handled by private wire and not by radio. Exclusive use of a telegraph wire between New York and Philadelphia from 8 a. m. to 6 p. m. daily costs \$2,000 per annum; such a telephone circuit costs \$4,000 per annum. There is undoubtedly some saving in the use of radio, and the stations on the roofs of the Wanamaker stores are distinctive features of interest to sight-seeing parties.

Neglecting the unnecessary overland work of the Wanamaker stations, if the figures given represent average conditions, one station could easily handle all the ship business of the port of New York under average conditions by handling 3.2 messages per hour, but as the sailings and arrivals of ships are not always uniform, it is probable that two stations would be necessary for the work during rush hours as when steamers due are fog bound outside and passengers are delayed.

If the paid business of the port of New York (Wanamaker business being all private) does not amount on the average to more than 3.2 messages per hour, the indications are that the amount of business is not great anywhere and the commercial companies will not be giving up much in the matter of actual receipts for radio traffic if they sell their systems. The rate per word at the Sea Gate Station is 6 cents for ships in North and South American trade and 12 cents for ships in the transoceanic trade; therefore, Sea Gate's average daily earnings for 10 days, allowing half at each rate, were \$70.48. The rate per word of the Bush Terminal Station is the same, but their transoceanic ship business is believed to be nil. The average daily earnings of that station at 6 cents per word would be \$17.50. This is assuming that all the above traffic is paid business; service messages, press, etc., being eliminated.

The above bears out the claims that the operation of shore stations is not in itself a paying venture and that the amount of traffic between ship and shore is very greatly exaggerated. Also, that the profit comes from the renting of apparatus and furnishing of operators to merchant ships.

Gov. Griggs made the statement (pp. 169-170) that the Marconi Co. had not made sufficient profits to justify a dividend upon its stock after 16 years of operation.

From the following figures taken from the "Annual Report of the Directors of Marconi Wireless Telegraph Co. of America" for the year ending December 31, 1915, it should be noted that for the year 1914 the company derived a greater income from investment of surplus funds than it did from net earnings from operations, by \$28,659.71, while for the year 1915 the net earnings exceeded the income from investments by \$79,128.72. In that year the company made from investments \$104,932.97.

I have not yet found any record of a discussion in the interdepartmental committee concerning the method by which the Government would acquire radio stations offered for sale "at a reasonable valuation." In one part of the discussion it was stated that, since Congress would eventually appropriate money to carry that feature of the bill into effect, at that time a method of expending the money for this purpose would be proposed. It was always the sentiment in the committee that the purchase should be accomplished so as to

do the least harm to commercial interests, and the words "reasonable valuation" were taken to express the idea that the Government would pay all that was justly due to the owners for any station taken over.

Referring to the statements made by me before the committee as shown on pages 26 and 133 of the record, I believe that should Congress decide to obtain a Government monopoly of the shore radio stations used for commercial purposes, a commission should be authorized by Congress to enter into negotiations with all private interests concerned and come to an agreement with them on the value of their properties. Should the commission fail to agree on proper terms with any company operating radio stations, the stations should be taken over by the Government through condemnation proceedings and the real value of the properties obtained and paid, as is now provided. In this way the term "reasonable valuation" would disappear, and the actual value would be paid, which is the desired end.

I request that this letter and the report appended be printed with the hearings before your committee.

Respectfully,

D. W. TODD,
Commander, United States Navy.

Hon. J. W. ALEXANDER, M. C.,
*Chairman Committee on Merchant Marine and Fisheries,
House of Representatives, Washington, D. C.*

NAVY YARD,
New York, October 19, 1916.

From: Board on Radio Interference.

To: Bureau of Steam Engineering, Navy Department.

Subject: Interference caused by the operation of the radio stations on Wanamaker stores at Philadelphia and New York, with the naval radio stations at those places.

1. In accordance with reference (a) the board met at the naval radio station at Philadelphia at 10 a. m., October 16, 1916.

2. From observations made at Philadelphia the following facts were established:

Daily, except Sunday, from 8 a. m. to 5.30 p. m., the Wanamaker station at Philadelphia (it will hereafter be referred to as WHE) does considerable work with the New York Wanamaker station. Sundays and at other times than those specified WHE works with commercial ships. WHE works New York on 1,650 meters and commercial ships on 600 meters. This latter work is intermittent and does not amount to much.

With the apparatus at present installed at the Philadelphia Naval Station it is possible to work with the New York Naval Station on 950 and 1,200 meters and below, it is possible to work with a battleship 150 miles distant on 950 and 1,200 meters, it is possible to work with a destroyer 100 miles distant on 1,200, 950, or 750 meters; all the above while WHE is sending on full power, using a wave length of 1,650 meters.

The latter facts were deduced from actual tests as follows:

Messages from New York (NAH) on 1,200 meters were received at Philadelphia while WHE was sending, the radiation at New York being 24, 18, and 12 amperes and the audibility at Philadelphia when tuned for the best signal was 400, 16, and 12, respectively. The Wanamaker station (WHE) does not interfere badly on 1,200 meters and below. Calls and messages from New York and Arlington can be read with ease on 950 meters with WHE sending on either 1,650 or 600 meters. A battleship at the New York yard, the *Pennsylvania*, sent a test message to Philadelphia on 1,200 meters. The received signal was extremely loud, using a coupling that cuts out WHE entirely. The *Pennsylvania* radiated 52 amperes, but it is believed that a ship radiating 30 amperes or even less could be read at a distance of 150 miles through WHE. A destroyer, the *Wainwright*, sent a test message to Philadelphia on 1,200 meters, radiating 18 amperes. This could be read through WHE easily.

It is not possible, save in exceptional circumstances, to work with the Arlington station on 2,400 meters through WHE. It is usually possible to read the Washington Navy Yard station on 2,400 meters through WHE. The loosest coupling and the most careful tuning would not cut down the signals from WHE enough to read Arlington or the Washington yard (NAL) surely. In an effort to better the existing conditions a small coupling coil and a variable con-

denser were put in the receiver's secondary (an I-P-76 receiver, 1914 model, is in use at Philadelphia), an extremely sensitive crystal detector and an audion detector were tried. These additions bettered conditions for working Arlington somewhat, but were not sufficient.

The Philadelphia Wanamaker station consists of a low frequency set, using a nonsynchronous rotary gap. The power usually is 6 or 7 kilowatts. Unless constantly adjusted the spark points on this gap burn away, increase the gap length, and so broaden the transmitted wave.

3. From observations made at New York the following facts were established:

Daily, except Sunday, from 8 a. m. till 5.30 p. m., the Wanamaker station at New York (it will hereafter be referred to as WHI) does considerable work with the Philadelphia Wanamaker station. The wave length used is about 1,800 meters. With the apparatus as installed in the naval radio station at New York (Navy standard receiver type Ab) it is always possible to work Philadelphia on 950 meters. From tests with the *Connecticut* at Philadelphia it is thought that it would always be possible to work a battleship distant 150 miles on 950 meters. It is always possible to work Arlington on 950 meters except when a spark is bad. Using the loosest coupling and the most careful tuning it is not possible to work Arlington on 2,400 meters through WHI. Under similar conditions it is not possible to read Philadelphia through WHI at all times. In fact, on wave lengths from 1,000 to 2,400 meters interference from WHI is bad.

Due to the fact that the calling waves of Arlington, Philadelphia, Newport, and various ships are different, it is necessary to use only the primary circuit and an untuned secondary for listening for calls. On this listening-in circuit WHI covers the entire scale from 300 to 3,000 meters. It is just possible to make out calls from Arlington through him.

The Wanamaker station at New York is similar to the one at Philadelphia, and has a similar difficulty in keeping a sharp tune.

4. The following conclusions are reached:

(a) The difficulty at both New York and Philadelphia is not due to poor work on the part of the operator.

(b) The apparatus of the New York and Philadelphia stations is as good at least as at the average station, but at both places the conditions are exceptionally bad as to interference from other stations. These conditions warrant the installation of exceptionally good apparatus.

(c) The Wanamaker stations at both places are overpowered and their tuning is broader than it would be were a conscientious effort made to improve it. The operators at WHE are very accommodating and will stop at any time to let the Navy work through. This is not so true in New York. The receivers used at WHE and WHI are of an old type and not selective. The detectors are not sensitive. With improved receiving apparatus at both stations the work could easily be done with 3 kilowatts. With WHI and WHE working, any communication with New York and Philadelphia on 1,500 meters or 1,900 meters is impossible; hence if it is desired to keep these tunes open for use at New York and Philadelphia, the Wanamaker stations must be done away with or the tunes shifted to a very long wave.

5. The following recommendations, which it is believed will materially better conditions at both places, are offered:

Change the working waves of certain naval stations as follows: Norfolk to ---, Arlington to ----, and Philadelphia to ----.

Limit the power that the Wanamaker stations use to 3 kilowatts.

Change the working waves of both Wanamaker stations to 1,800 meters. This will better working conditions at the New York and Philadelphia Naval Stations, and this change is desired by the operators at WHE and WHI to better their condition.

H. P. LECLAIR,
Lieutenant (Junior Grade), United States Navy.
W. A. EATON,
Gunner, United States Navy.
E. A. FORBES,
Expert Radio Aid, United States Navy.

The following are articles of the London convention submitted by Commander D. W. Todd, in reply to a question by the chairman, on page 16 of the hearing:

ARTICLE 1.

Scope.—The high contracting parties bind themselves to apply the provisions of the present convention to all radio stations (both coastal stations and stations on shipboard) which are established or worked by the contracting parties and open to public service between the coast and vessels at sea.

They further bind themselves to make the observance of these provisions obligatory upon private enterprises authorized either to establish or work coastal stations for radiotelegraphy open to public service between the coast and vessels at sea, or to establish or work radio stations, whether open to general public service or not, on board of vessels flying their flag.

ARTICLE 2.

Coast stations.—By "coastal stations" is to be understood every radio station established on shore or on board a permanently moored vessel used for the exchange of correspondence with ships at sea.

Every radio station established on board any vessel not permanently moored is called a "station on shipboard."

ARTICLE 3.

Intercommunication.—The coastal stations and the stations on shipboard shall be bound to exchange radiograms without distinction of the radio system adopted by such stations.

Every station on shipboard shall be bound to exchange radiograms with every other station on shipboard without distinction of the radio system adopted by such stations.

However, in order not to impede scientific progress, the provisions of the present article shall not prevent the eventual employment of a radio system incapable of communicating with other systems, provided that such incapacity shall be due to the specific nature of such system and that it shall not be the result of devices adopted for the sole purpose of preventing intercommunication.

ARTICLE 4.

Limited service.—Notwithstanding the provisions of article 3, a station may be reserved for a limited public service determined by the object of the correspondence or by other circumstances independent of the system employed.

ARTICLE 5.

Land-line connection.—Each of the high contracting parties undertakes to connect the coastal stations to the telegraph system by special wires, or, at least, to take other measures which will insure a rapid exchange between the coastal stations and the telegraph system.

ARTICLE 6.

The high contracting parties shall notify one another of the names of coastal stations and stations on shipboard referred to in article 1, and also of all data necessary to facilitate and accelerate the exchange of radiograms, as specified in the regulations.

ARTICLE 8.

Interference.—The working of the radio stations shall be organized as far as possible in such manner as not to disturb the service of other radio stations.

ARTICLE 9.

Radio stations are bound to give absolute priority to calls of distress from whatever source, to similarly answer such calls, and to take such action with regard thereto as may be required.

ARTICLE 19.

The high contracting parties bind themselves to take or propose to their respective legislatures the necessary measures for insuring the execution of the present convention.

ARTICLE 21.

The high contracting parties shall preserve their entire liberty as regards radio installations other than provided for in article 1, especially naval and military installations, and stations used for communications between fixed points. All such installations and stations shall be subject only to the obligations provided for in articles 8 and 9 of the present convention.

However, when such installations and stations are used for public maritime service they shall conform, in the execution of such service, to the provisions of the regulations as regards the mode of transmission and rates.

On the other hand, if coastal stations are used for general public service with ships at sea and also for communication between fixed points, such stations shall not be subject, in the execution of the last-named service, to the provisions of the convention except for the observance of articles 8 and 9 of this convention.

ARTICLE I.

Service regulations.—The choice of radio apparatus and devices to be used by the coastal stations and stations on shipboard shall be unrestricted. The installation of such stations shall as far as possible keep pace with scientific and technical progress.

ARTICLE II.

Wave lengths.—Two wave lengths, one of 600 meters and the other of 300 meters, are authorized for general public service. Every coastal station opened to such service shall be equipped in such manner as to be able to use these two wave lengths, one of which shall be designated as the normal wave length of the station. During the whole time that a coastal station is open it shall be in condition to receive calls according to its normal wave length. For the correspondence specified under paragraph 2 of Article XXXV, however, a wave length of 1,800 meters shall be used. In addition, each Government may authorize in coastal stations the employment of other wave lengths designed to insure long-range service or any service other than for general public correspondence established in conformity with the provisions of the convention under the reservation that such wave lengths do not exceed 600 meters or that they do exceed 1,600 meters.

In particular, stations used exclusively for sending signals designed to determine the position of ships shall not employ wave lengths exceeding 150 meters.

ARTICLE III.

1. Every station on shipboard shall be equipped in such manner as to be able to use wave lengths of 600 meters and of 300 meters. The first shall be the normal wave length and may not be exceeded for transmission except in the case referred to under Article XXXV (paragraph 2).

Other wave lengths, less than 600 meters, may be used in special cases and under the approval of the managements to which the coastal and shipboard stations concerned are subject.

2. During the whole time that a station on shipboard is open it shall be able to receive calls according to its normal wave length.

3. Vessels of small tonnage which are unable to use a wave length of 600 meters for transmission may be authorized to employ exclusively the wave length of 300; they must be able to receive a wave length of 600 meters.

ARTICLE IV.

Wave lengths.—Communication between a coastal station and a station on shipboard shall be exchanged on the part of both by means of the same wave length. If, in a particular case, communication is difficult, the two stations may, by mutual consent, pass from the wave length with which they are communicating to the other regulation wave length. Both stations shall resume their normal wave length when the exchange of radiograms is finished.

ARTICLE V.

1. *Berne list.*—The International Bureau shall draw up, publish, and revise from time to time an official chart showing the coastal stations, their normal ranges, the principal lines of navigation, and the time normally taken by ships for the voyage between the different ports of call.

2. It shall draw up and publish a list of radio stations of the class referred to in Article I of the convention, and from time to time supplements covering additions and modifications.

ARTICLE VI.

Superfluous signals.—The exchange of superfluous signals and words is prohibited to stations of the class referred to in Article I of the convention. Experiments and practice will be permitted in such stations in so far as they do not interfere with the service of other stations.

Practice shall be carried on with wave lengths different from those authorized for public correspondence, and with the minimum of power necessary.

ARTICLE VII.

1. *Reduced power.*—All stations are bound to carry on the service with the minimum of energy necessary to insure safe communication.

2. Every coastal or shipboard station shall comply with the following requirements:

(a) The waves sent out shall be as pure and as little damped as possible.

(b) The apparatus shall be able to transmit and receive at a speed equal to at least 20 words a minute, words to be counted at the rate of 5 letters each.

(c) Receiving apparatus shall be able to receive, with the greatest possible protection against interference, transmission of the wave lengths specified in the present regulations, up to 600 meters.

3. *Fog signals.*—Stations serving solely for determining the position of ships (radiophares) shall not operate over a radius greater than 30 nautical miles.

ARTICLE VIII.

Range.—Independently of the general requirements specified under Article VII, stations on shipboard shall likewise comply with the following requirements:

(a) The power transmitted to the radio apparatus, measured at the terminals of the generator of the station, shall not, under normal conditions, exceed one kilowatt.

(b) Subject to the provisions of Article XXXV, paragraph 2, power exceeding one kilowatt may be employed when the vessel finds it necessary to correspond while more than 200 nautical miles distant from the nearest coastal station, or when, owing to unusual circumstances, communication can be established only by means of an increase of power.

ARTICLE IX.

1. *License.*—No station on shipboard shall be established or worked by private enterprise without a license issued by the Government to which the vessel is subject.

ARTICLE X.

1. *Operators.*—The service of the station on shipboard shall be carried on by a telegraph operator holding a certificate issued by the Government to which the vessel is subject, or in case of necessity and for one voyage only, by some other adhering Government.

* * * * *

3. The certificate shall furthermore state that the Government has bound the operator to secrecy with regard to the correspondence.

4. The radio service of the station on shipboard shall be under the superior authority of the commanding officer of the ship.

ARTICLE XIII.

(a) Coastal stations:

1. *Hours of service.*—The service of coastal stations shall, as far as possible, be constant, day and night, without interruption.

Certain coastal stations, however, may have a service of limited duration. The management of the radio service of each country shall fix the hours of service.

2. The coastal stations whose service is not constant shall not close before having transmitted all their radiograms to the vessels which are within their radius of action, nor before having received from such vessels all the radiograms of which notice has been given. This provision is likewise applicable when vessels signal their presence before the actual cessation of work.

(b) Stations on shipboard:

3. *Classification of ship stations.*—Stations on shipboard shall be classed under three categories:

- (1) Stations having constant service;
- (2) Service stations having a service of limited duration;
- (3) Stations having no fixed working hours.

(A) SIGNALS OF TRANSMISSION.

ARTICLE XX.

Code.—The signals to be employed are those of the Morse International Code.

ARTICLE XXI.

Distress.—Ships in distress shall use the following signal:

● ● ● — — — — — ● ● ●

repeated at brief intervals, followed by the necessary particulars.

As soon as a station hears the signal of distress it shall cease all correspondence and not resume it until after it has made sure that the correspondence to which the call for assistance has given rise is terminated.

Stations which hear a signal of distress shall conform to the instructions given by the ship making such signal as regards the order of the messages or their cessation.

In case the call letters of a particular station are added at the end of the series of calls for assistance, the answer to the call shall be incumbent upon that station alone unless such station fails to reply. If the call for assistance does not specify any particular station, every station hearing such call shall be bound to answer it.

ARTICLE XXXV.

1. *Nearest station.*—In general, the shipboard stations shall transmit their radiograms to the nearest coastal station.

Nevertheless, if a shipboard station has the choice between several coastal stations at equal or nearly equal distances, it shall give the preference to the one established on the territory of the country of destination or normal transit for its radiograms.

2. A sender on board a vessel shall, however, have the right to designate the coastal station through which he desires to have his radiogram transmitted. The station on shipboard shall then wait until such coastal station shall be the nearest.

In exceptional cases transmission may be made to a more distant coastal station, provided that—

(a) The radiogram is intended for the country in which such coastal station is situated and emanates from a ship subject to that country.

(b) Both stations use for calling and transmission a wave length of 1,800 meters.

(c) Transmission with this wave length does not interfere with a transmission made by means of the same wave length by a nearer coastal station.

(d) The station on shipboard is more than 50 nautical miles distant from any coastal station given in the list. The distance of 50 miles may be reduced to 25 miles provided the maximum power at the terminals of the generator

does not exceed 5 kilowatts and that the stations on shipboard are established in conformity with Articles VII and VIII. This reduction in the distance shall not be admissible in the seas, bays, or gulfs of which the shores belong to one country only and of which the opening to the high sea is less than 100 miles wide.

ARTICLE XLV.

* * * * *
4. The managements of the radio service shall give to agencies of maritime information such data regarding losses and casualties at sea, or other information of general interest to navigation, as the coastal stations may properly report.

ARTICLE XLVI.

Ship-to-ship business.—The exchange of correspondence between shipboard stations shall be carried on in such a manner as not to interfere with the service of the coastal stations, the latter, as a general rule, being accorded the right of priority for the public service.

(The chairman announced that the hearings on H. R. 19350 were closed.)

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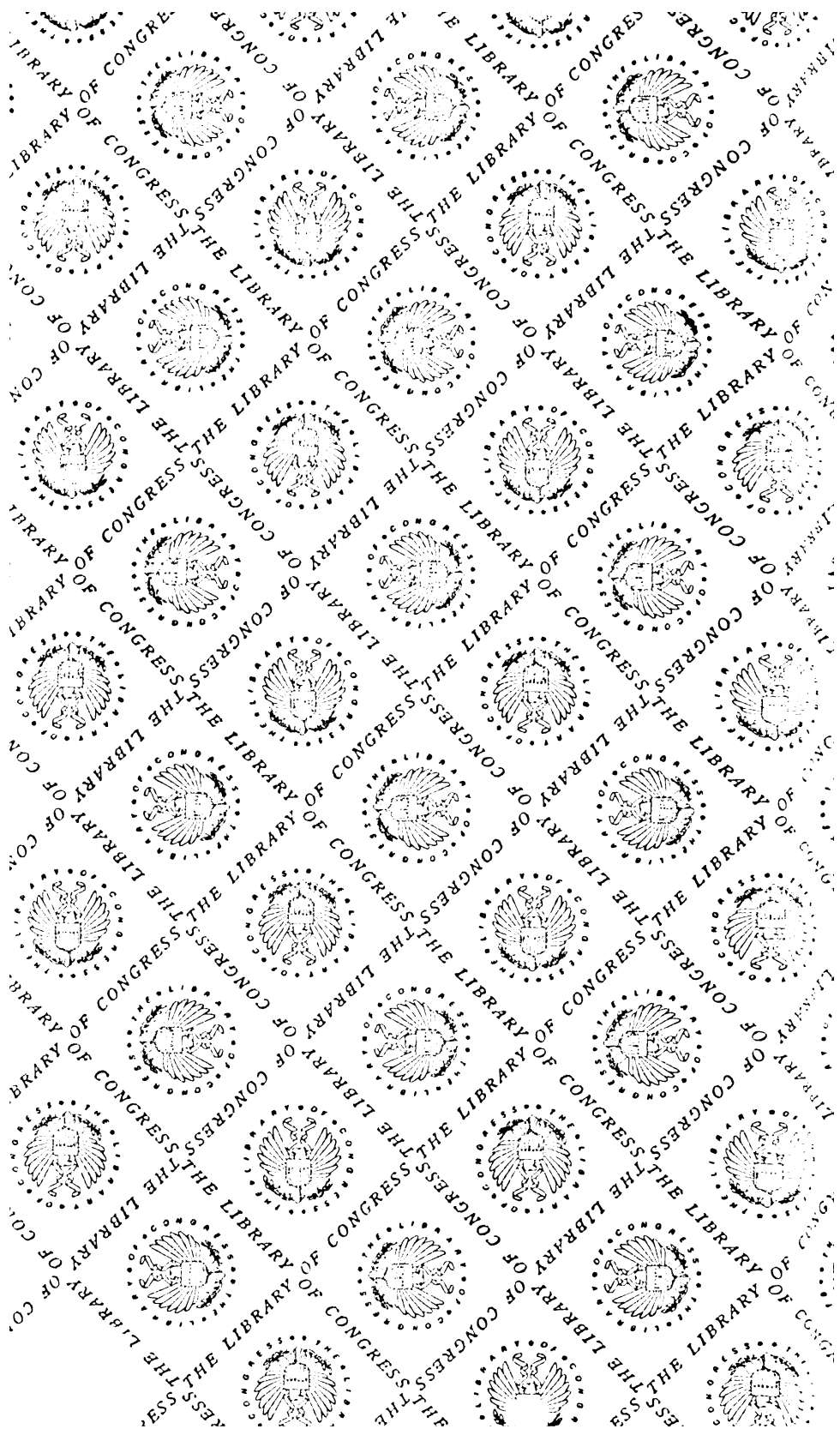
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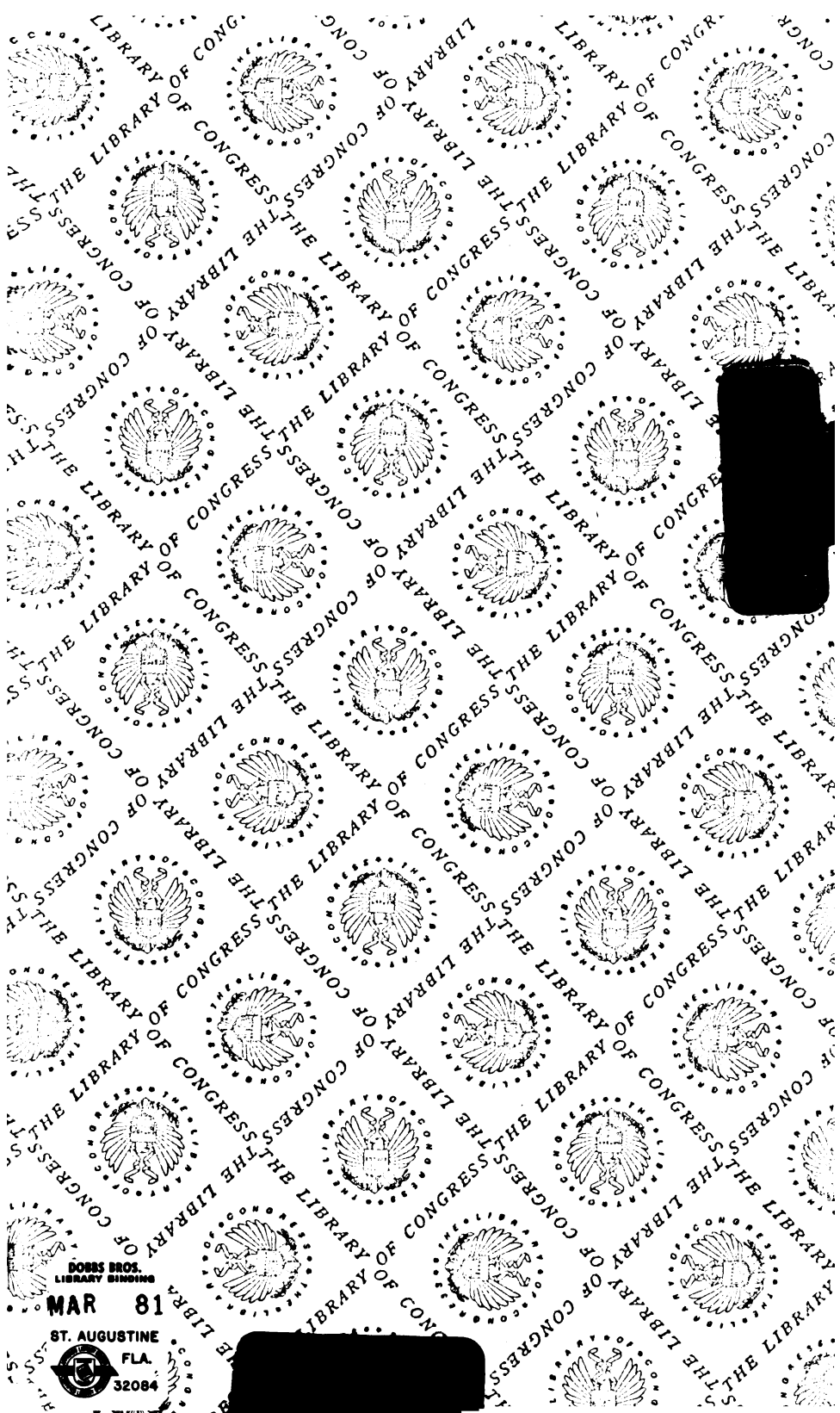
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